

Blackleaf Wildlife Management Area Vegetation Condition and Trend 1979-2009



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Introduction

The Blackleaf Wildlife Management Area (BLWMA) lies in the foothills of the Sawtooth Range of the Rocky Mountains east of the Continental Divide, in northwestern Teton County (see map, Appendix 1). Great Falls, Montana, is 85 miles south and east from the BLWMA. Montana Department of Fish, Wildlife and Parks owns and manages the 11,107-acre unit for vegetation and wildlife enhancement as well as public recreation.

Topography varies from flat, sub-irrigated meadows and marshes to rolling hills to high timbered and rocky outcrops on the west boundary of the property. Several small streams run from west to east. Elevation varies from 4,300 to 6,700 feet. Annual precipitation ranges from 15-20 inches.

The BLWMA originated in 1979, followed by several additional land purchases to provide winter range for elk and mule deer. The area is considered important spring and summer habitat for black and grizzly bears, and, due to habitat diversity and arrangement, provides important habitat for game and non-game birds, mammals, reptiles and amphibians.

One of the primary goals for the BLWMA is to emphasize the occurrence of highly productive, diverse plant communities that will provide the best possible quality forage and cover for native wildlife species. Prairie vegetation is managed with emphasis on rough fescue (*Festuca scabrella*) because of its palatability to big game species. Rough fescue is considered a climax species in mountain-foothill zones of Montana which provides benchmarks for determining rangeland condition (Ross, Murray and Haigh, 1973, and Ross and Hunter, 1976). The species is also preferred winter forage by elk (Jourdonnais and Bedunah, 1990). It is therefore considered an indicator of overall grassland health. Numerous studies have shown that, if this plant is carefully managed, the entire plant community moves toward a more productive, vigorous climax. The rough fescue/Idaho fescue habitat type as described by Mueggler and Stewart (1980) and Harvey (1980) is one of the most productive in western Montana.

A range condition and trend survey initiated shortly after purchase in 1979 revealed that the majority of the grasslands on the BLWMA were in fair condition, based upon Soil Conservation Service (now NRCS) range condition criteria (poor, fair, good, excellent). As a result the entire area was rested from livestock grazing through 1989 in order to allow plant communities to regain vigor and productivity. Eleven years of rest allowed plants to recuperate without intensive livestock grazing pressure. Permanent vegetation transects were established in 1979 and re-read in 1986-87, 1993, 1997, 2001, 2005 and 2009. Several range sites were sampled specifically because of poor soils and exposure. Sites with deeper and richer soils have shown a more dramatic increase in range condition.

In June of 1990, a rotational grazing system was initiated utilizing livestock from neighboring ranches (Olson, 1992). The grazing system is designed to duplicate, as nearly as possible, natural ungulate grazing. Each unit is grazed for 6-7 weeks, beginning approximately June 1, and then allowed complete rest for 3 full growing seasons. Pasture units 1-8 provide livestock grazing on the WMA (see Appendix 1). Units are maintained using portable solar-powered electric fencing. Electric fences are removed at the end of each grazing season.

Methods

Fourteen permanently marked transects were established on the BLWMA immediately after purchase in 1979 (Appendix 2). Steel posts identify each transect, with shorter lengths of rebar 100 feet apart marking the beginning and end. A 100-foot tape is stretched between the rebar stakes and measurements recorded at 5-foot intervals (beginning at the 5-foot marker on the tape). A 20x50 centimeter quadrat is used to record basal cover and frequency for all species encountered. Twenty samples are collected from each 100-foot transect. Ocular basal cover (%) values are collected at approximately 1 inch above ground to accommodate measuring “mat-forming” species that spread laterally along the ground surface.

Data from 14 transects were recorded during summers of 1979-80, 1986-87, 1993, 1997, 2001, 2005 and 2009. Transect locations are presented in Appendix 2. Basal cover values for all years are summarized in Appendix 4. Transects were read from late June through late August.

A regression equation and trend line comparing percent relative basal cover values over the past 30 years is used to evaluate individual plants' changes compared to the total vegetative community. R-squared correlation coefficients of 0.50 or more are considered thresholds to indicate the presence or absence of a significant relationship (Fowler and Cohen 1993).

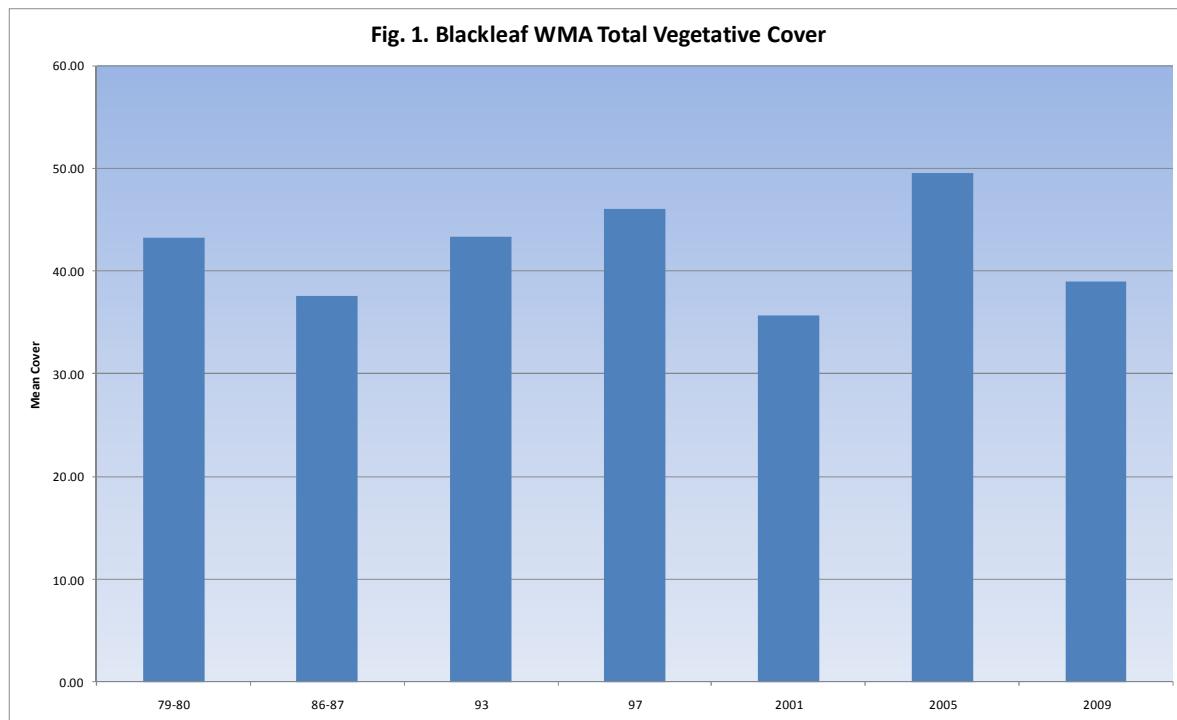
Results and Discussion

General Trends – Mean Percent Basal Cover/Relative Cover

Overall, vegetation condition has improved on sampled areas of the BLWMA. Vegetation condition and trend are estimated based upon mean basal cover and relative cover values for individual plant species. Mean basal cover is derived from the average percent cover for each species per transect divided by the total number of transects. Relative cover, or composition, is the mean percent cover for each individual species divided by the mean total percent plant cover. Relative cover records the changes in individual plant cover compared to rest of the plant community. Mean percent basal cover values for 9 grasses and sedges plus 23 forbs and shrubs were tabulated and summarized by transect (Appendix 4) and are considered the more important plants in terms of frequency of occurrence and basal cover values in the plant community. Approximately 75

less abundant species or species groups were summarized but are not included in the Appendix 4 summary.

Total vegetative cover for 106 plant species over the 30-year period varied between 35% and 50%, with no consistent trend over time (Figure 1). The lowest recorded value for total cover (35%) occurred in 2001, coinciding with severe drought conditions during that same year.



Relative cover (composition) values for total grasses and forbs/shrubs generally showed a very significant decline in forb/shrub cover and a very significant increase in grasses (Figures 2 and 3). Much of the variation in forb/shrub cover was due to an overall increase in one shrub species, horizontal juniper, which masked a more accelerated decline in most other forb and prairie shrub species. In addition, severe drought conditions during 2001 appeared to interrupt plant cover trends.

Ten species of grasses, forbs and shrubs that are the most frequently encountered and account for the greatest cover values during sampling efforts from 1979-2009 are compared in Figures 4 - 6. These species accounted for 48.6 % of the plant community cover in 1979 compared to 66.4% in 2009. Rough fescue (Fesc) and horizontal juniper (Juho) are major contributors to these changes. Idaho fescue (Feid) and Parry danthonia (Dapa) showed minor cover increases over the 30 year period, while fringed sagewort (Arfr), phlox species (Phal, Phho), shrubby cinquefoil (PoFr), prairie junegrass (Kocr) and pussytoes (Anro) were either stable or declining.

Fig. 2. Grass Cover Trends

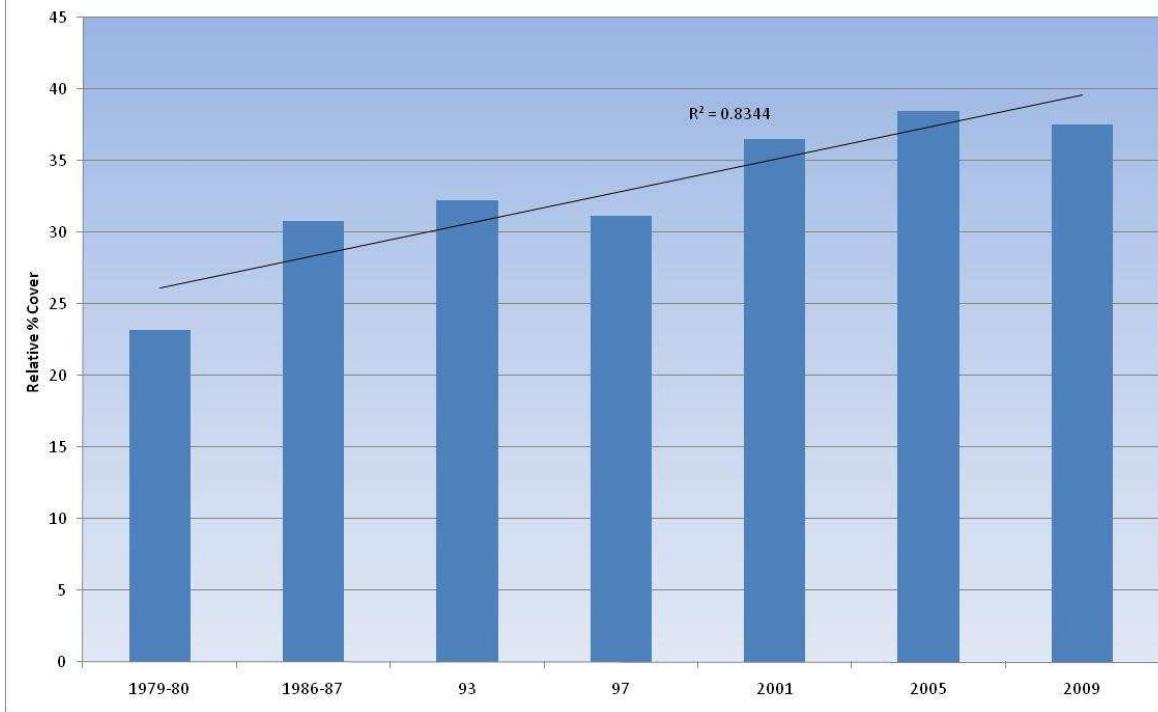


Fig. 3. Forb/Shrub Cover Trends

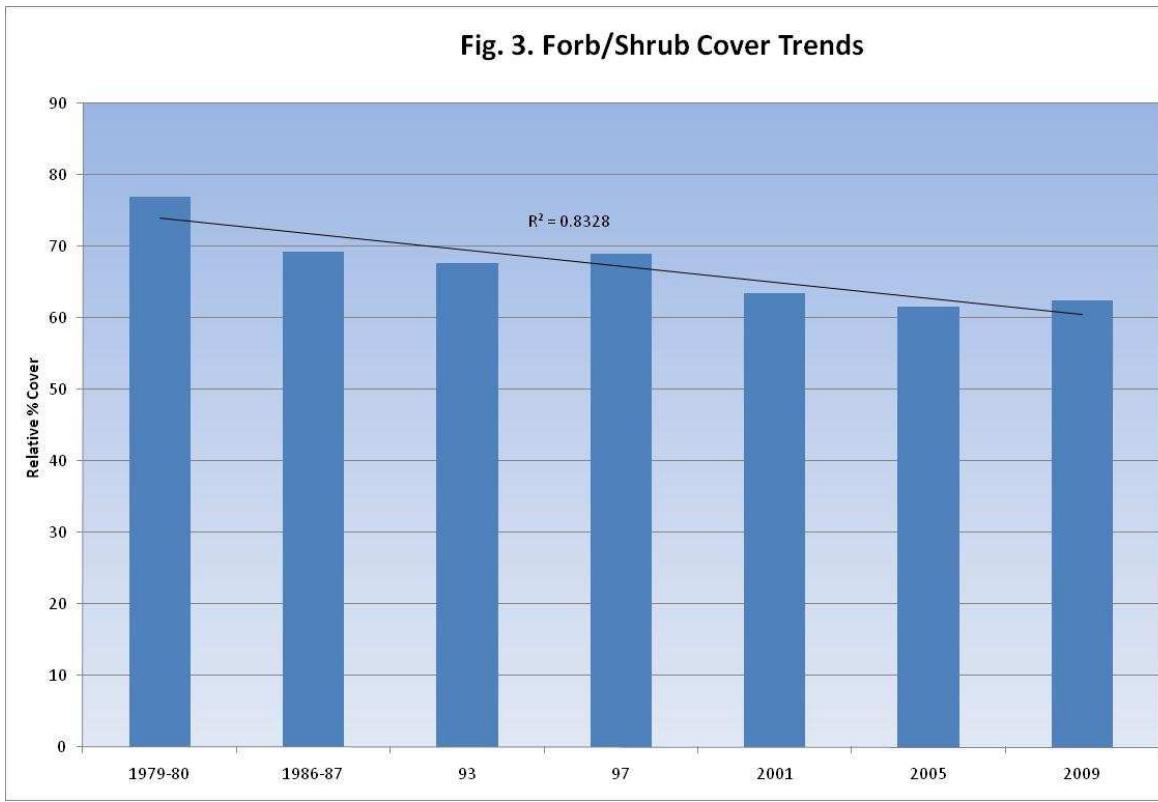


Fig. 4. 1979 Blackleaf WMA Relative Plant Cover %
(10 spp. = 48.6 % of total plant cover)

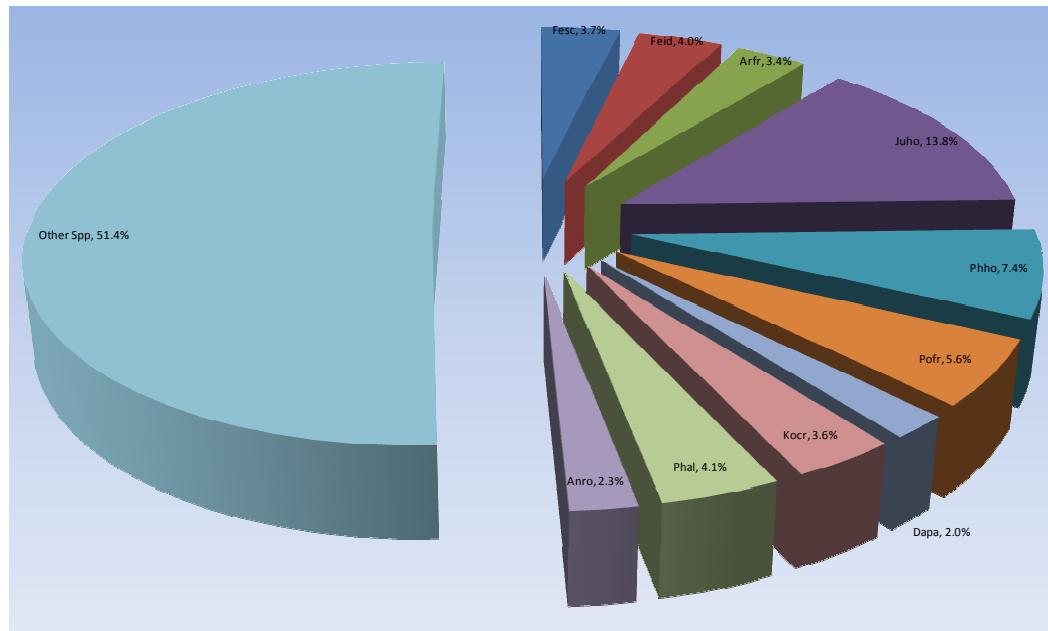
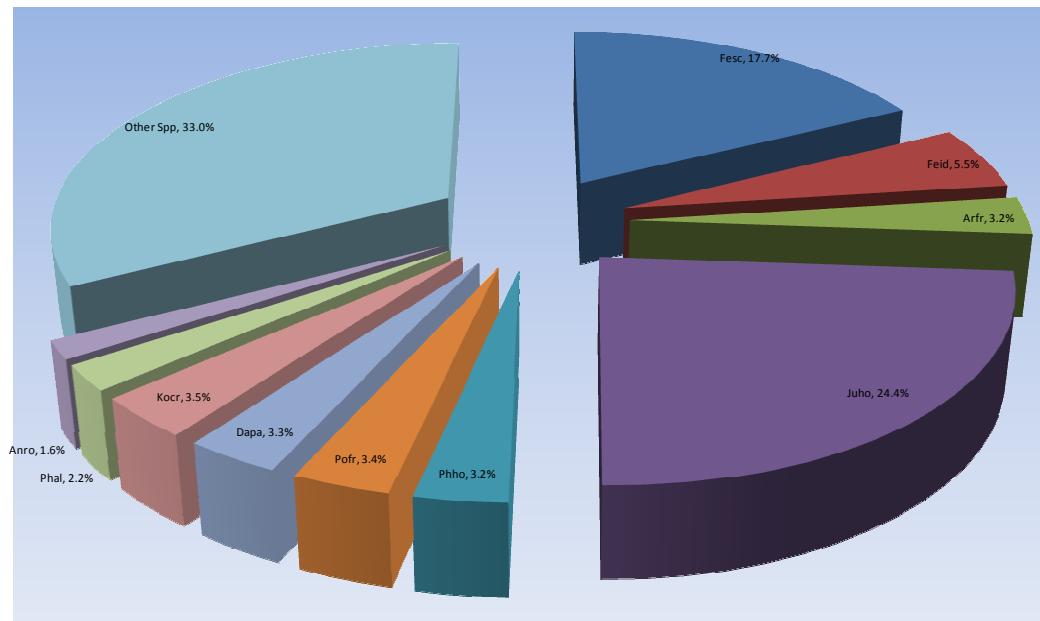
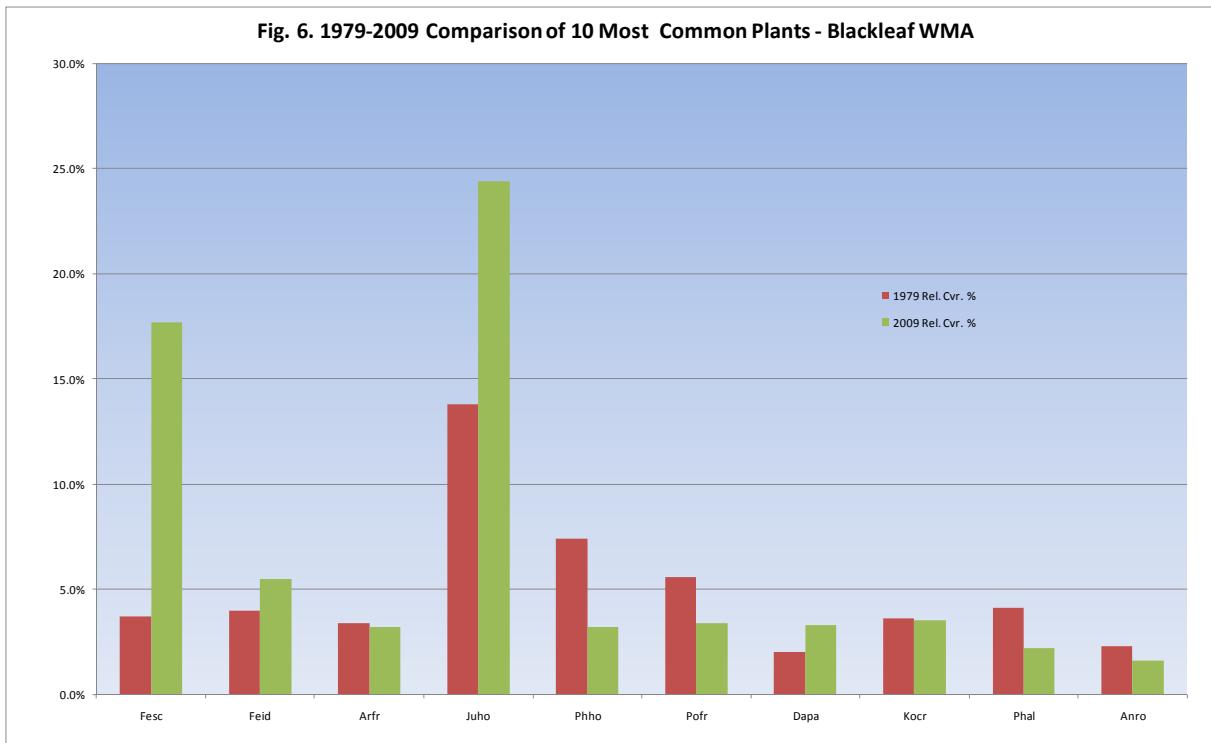


Fig 5. 2009 Blackleaf WMA Relative Plant Cover %
(10 spp. = 66.4 % of total plant cover)





Individual Species' Response – Relative Cover (Composition)

Composition values compiled over 30 years (7 sampling periods) for the 10 individual species of greatest abundance are presented in Figures 7- 10, and Appendix 3. It is important to note that rest-rotation livestock grazing was initiated on the Blackleaf WMA in 1990 and continued through 2009. Since almost all of the permanently marked transects are located within grazed areas since 1990 a grazing/non-grazing comparison is not possible. Transects marked with an asterisk in Appendix 4 tables were ungrazed from approximately 1990-2000, but are currently grazed.

Figure 7 illustrates the basal cover relationship of rough fescue to the rest of the plant community as recorded over a 30 year period. This graph represents a steady increase in basal cover. A simple linear regression was used to compare cover values over the 7 sampling periods. The correlation coefficient (R^2) of 0.79 suggests a strong upward trend over the sampling period. Overall, rough fescue cover in 2009 was four times the 1979 value.

Figure 8 shows a similar increasing trend in growth for horizontal juniper over the 30 year period, with a significant corresponding R^2 value of 0.66. Juniper cover has quadrupled since 1979, although showing very slight declines in 2005 and 2009 sampling efforts.

Fig. 7. *Festuca scabrella* (rough fescue)

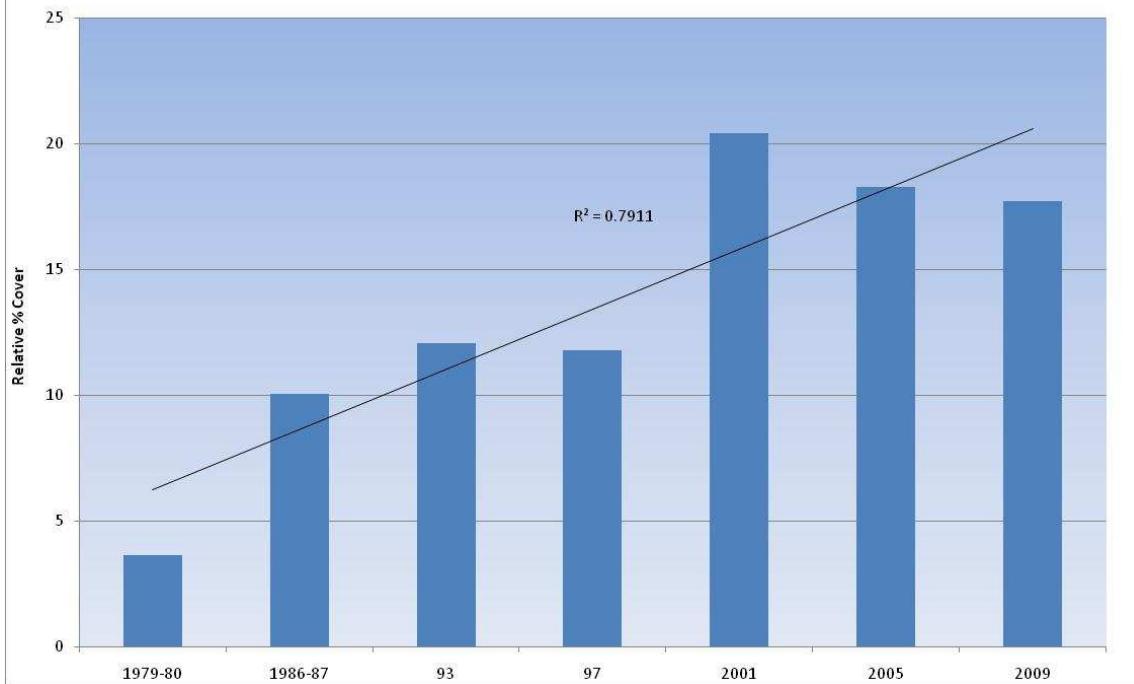
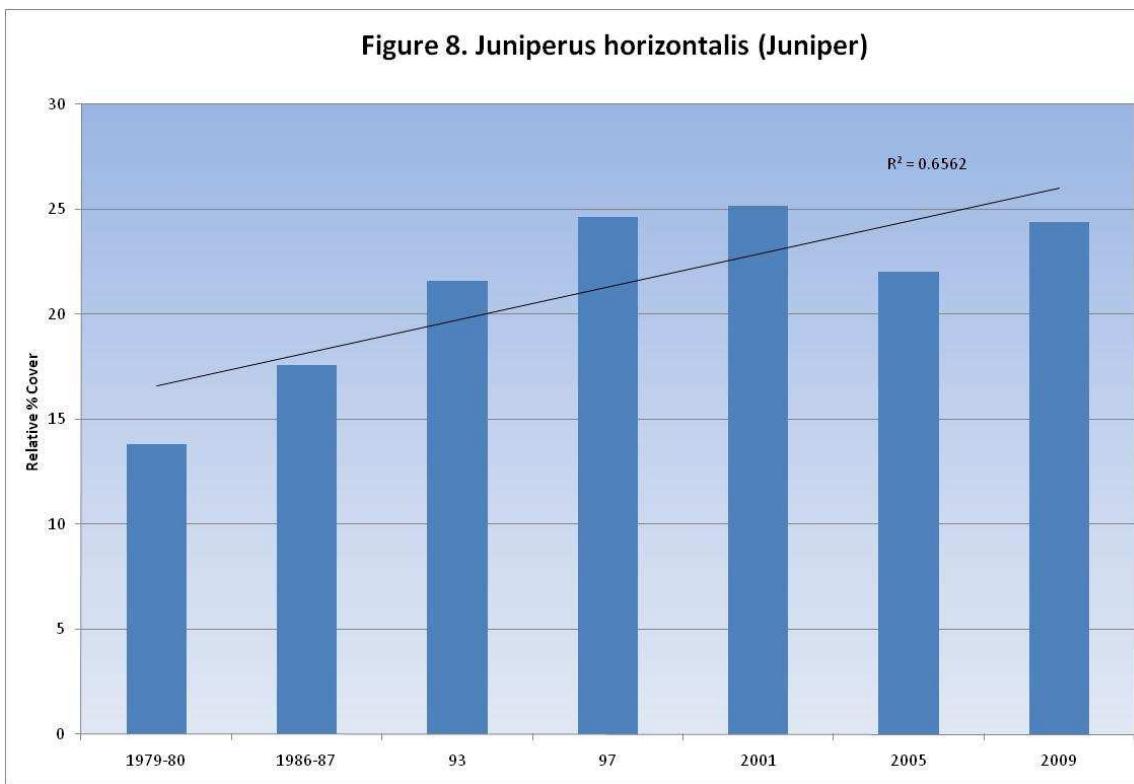
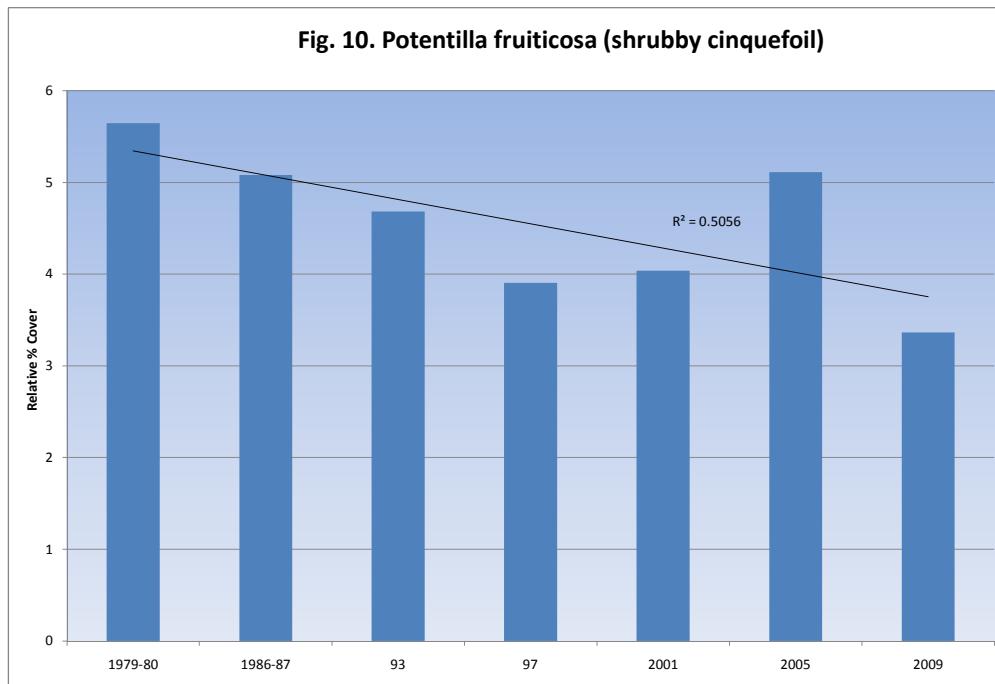
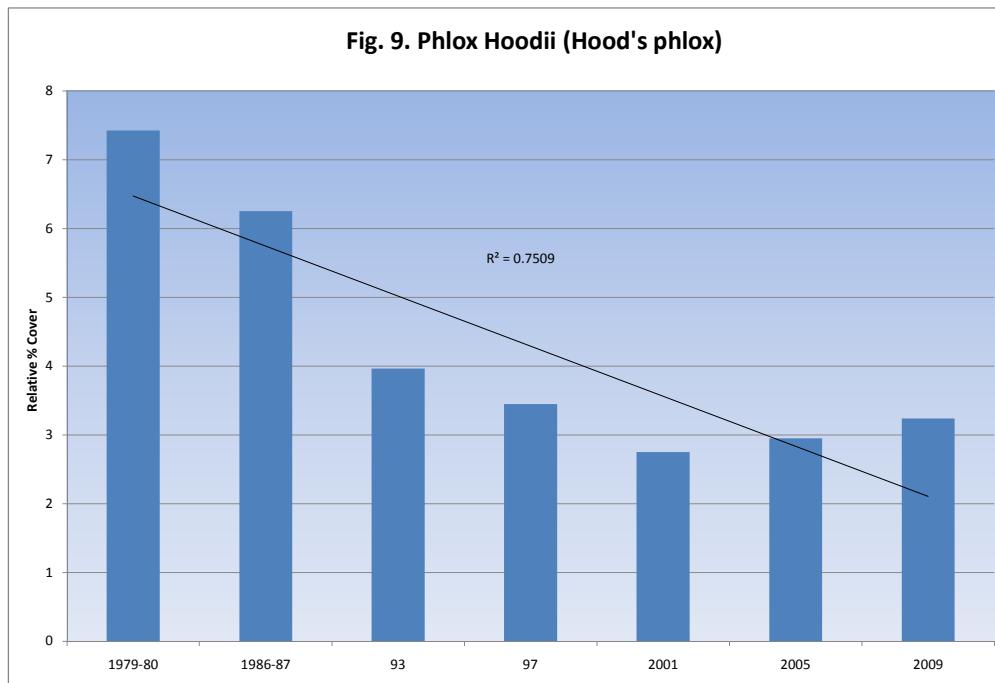


Figure 8. *Juniperus horizontalis* (Juniper)



Two species that revealed a marked decline in relative percent basal cover that were included in the more abundant top ten are illustrated in Figures 9 and 10. Hood's phlox has shown a significant decline as expressed by an R squared value of 0.75. The species was much more abundant from 1979-1987, but diminished steadily after 1987.



Shrubby cinquefoil has declined steadily over the 30 years sampling occurred, with only a minor variance noted in 2005. An R squared value of 0.51 would indicate a moderate– strongly significant difference over time. This data might be important to show to other range managers who are frequently encouraged to “spray out” woody species that are perceived to hamper grass production. Sharptailed grouse utilize this species for nesting cover and lek activities. In overgrazed areas, remnant species of palatable decreasers are frequently found in and around the crowns of cinquefoil; eradicating the plant only exposes these valuable remnant species to further grazing damage.

Of the 6 remaining dominant plant species, 3 showed no obvious upward or downward cover trends, although shorter term trends were noted for some species (see Appendix 3). These species include Parry oatgrass, Idaho fescue, and prairie junegrass.

In the case of Parry oatgrass, large increases were recorded through 1993, followed by declines through the rest of the 16 year observation period. Fluctuations in the cover data over the 30 years therefore showed no consistent trend. This species is a suspected competitor with rough fescue under intensive grazing conditions, but doesn't appear to be restricting rough fescue expansion on the Blackleaf WMA.

Prairie junegrass and Idaho fescue displayed similar results in that cover values varied widely between sampling periods, so that no clear trends in cover were observed.

The remaining 3 species, fringed sagewort, phlox, and pussytoes all (similarly) showed higher cover values from 1979 through 1987, then declines through 2009 (see Appendix 3).

Noticeable or obvious cover trends for other dominant species or species groups (of the 32 listed) in Appendix 3 include mountain douglasia, lupine, locoweed species, stemless nailwort, rose, and yellow pea.

Mountain douglasia, one of the earliest blooming “cushion plants” along the Rocky Mountain Front declined significantly over the past 30 years. Similar trends were observed for lupine, locoweed species, and stemless nailwort. Yellow pea declined dramatically in the first few years after FWP purchased the property and then remained at low levels. Rose increased also over the 30 year period, but below the selected level for significance.

Plant lists (common names, genus, species and codes) are presented in Appendices 5 and 6. Plant identification was performed in the field and has not been corroborated by a professional botanist.

Conclusions

Analysis of vegetation data from the past 30 years (1979-2009) indicates a significant increase in overall grass cover and a significant decline in forb/shrub cover on the BLWMA. Range condition has improved to “good-excellent” status (by NRCS standards applied in 1979) based upon significant improvement in rough fescue cover and declining influence of several forb species. Total vegetative cover (of all species) varies (35-48%) by sampling period and shows no significant upward or downward trend. Rough fescue, a very important deer and elk winter/spring forage species, has increased significantly in basal cover. Horizontal juniper, an important browse for mule deer in mountain-foothill prairie habitats, also exhibited a significant increase over the 30 year period.

Ten plant species that contributed approximately 49% of total ground cover value in 1979 increased to over 66% in 2009. These species include rough fescue, Idaho fescue, Parry danthonia, prairie junegrass, horizontal juniper, fringed sagewort, Hood’s phlox, shrubby cinquefoil, phlox and pussytoes. However, rough fescue and horizontal juniper were major contributors to the cumulative increase in cover by these ten species. Idaho fescue and parry danthonia exhibited very small increases in cover over the thirty year period. While prairie junegrass cover remained static, the remaining 5 forbs, Hood’s phlox, phlox, fringed sagewort, shrubby cinquefoil, and pussytoes, declined.

Six other commonly occurring forbs in the sampling area that showed significant downward trend in basal cover from 1979-2009 include mountain douglasia, stemless nailwort, lupine, and loco weed (*Oxytropis* spp.). Increases in rose cover were slightly below the selected threshold r-squared value of 0.50 (0.47) to indicate significant upward change.

Only two of fourteen permanently marked transects were located out of livestock grazing units, so it is difficult to compare vegetation information between grazed and ungrazed areas. It is apparent that the livestock grazing system initiated in 1990 has had no obvious negative impacts on the plant species discussed here, and, has likely contributed to the overall increase in beneficial species such as rough fescue.

Shrubby cinquefoil, a common shrub in open grassland habitats on the WMA, has declined over the past thirty years. This plant, a known increaser under intensive grazing, is often targeted for spraying, mowing and burning as a means of control by local ranchers who believe it out-competes valuable livestock-preferred grasses. This data may indicate that under proper grazing management, the species will decline without expensive treatments that may be harmful to wildlife. For instance, cinquefoil is important for sharptailed grouse lek selection, providing cover from aerial and ground predators. Thus, removal of extensive stands of cinquefoil will have negative consequences for sharptailed grouse. In addition, on severely over-grazed ranges, remnants of climax grasses,

such as rough fescue, can persist under the shrub's crown. Short-term measures to control the shrub may expose the grasses to excessive grazing pressure and eventually eliminate them, which erases any hope of range rehabilitation with existing native climax species. This data suggests that rotational grazing with adequate rest periods may reduce the species' cover without resorting to more harsh chemical and mechanical control methods.

Horizontal juniper, like shrubby cinquefoil, is often targeted by ranchers as a major contributor to declining grass production. The sample data indicates that under proper rest periods and rotation of livestock grazing, this important browse species will not negatively impact range condition and continue to provide valuable mule deer forage.

Finally, the thirty-year period of sampling on the Blackleaf WMA would suggest that significant vegetation changes are generally not obvious over a period of a few years. Vegetation monitoring of permanently marked transects on wildlife management areas and conservation easements is critical and should be encouraged at the time of acquisition in order to avoid erroneous conclusions based upon short-term trend information.

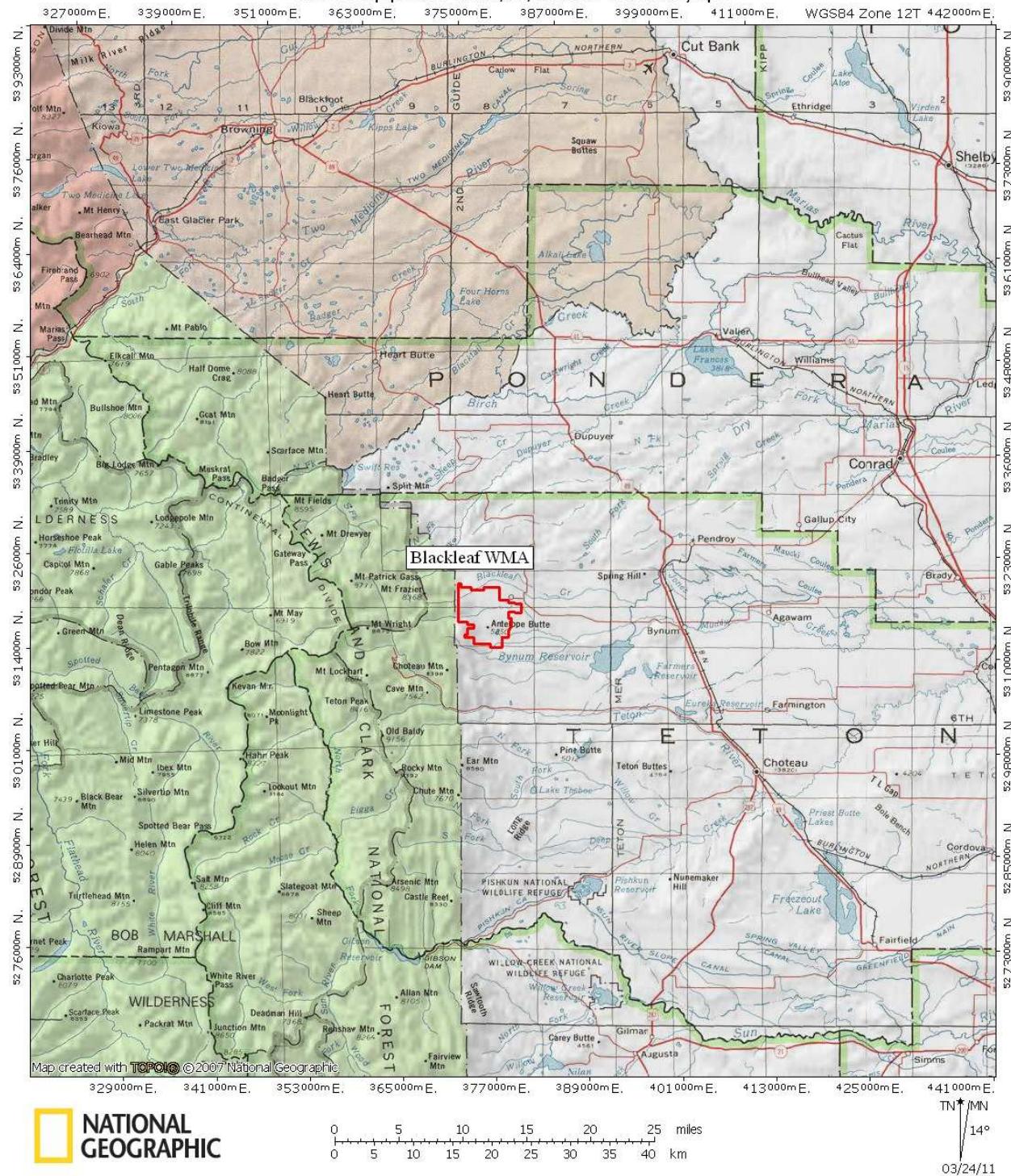
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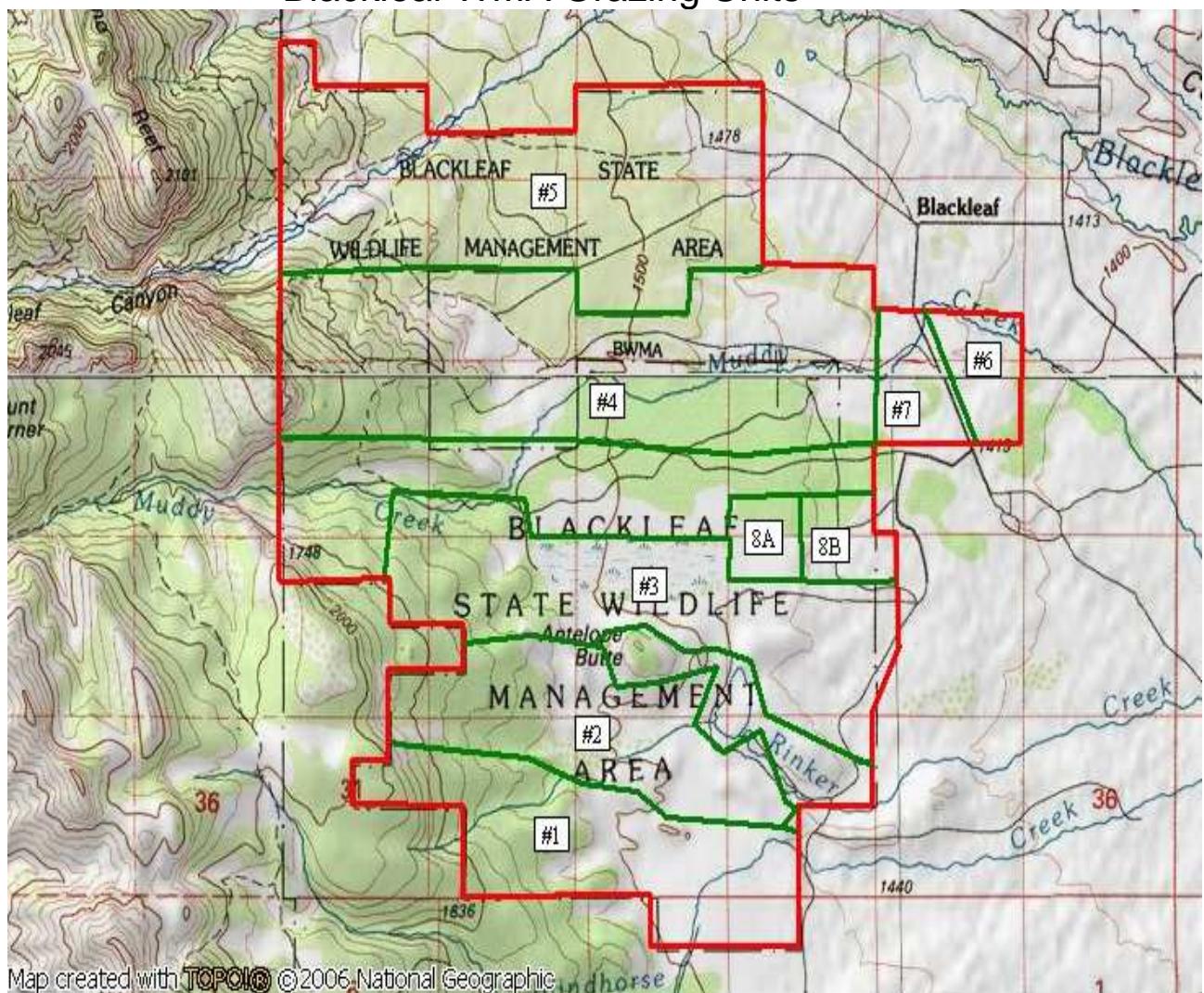
Appendix 1.

Blackleaf WMA Location Map

TOPO! map printed on 03/24/11 from "blkfbndry.tpo"

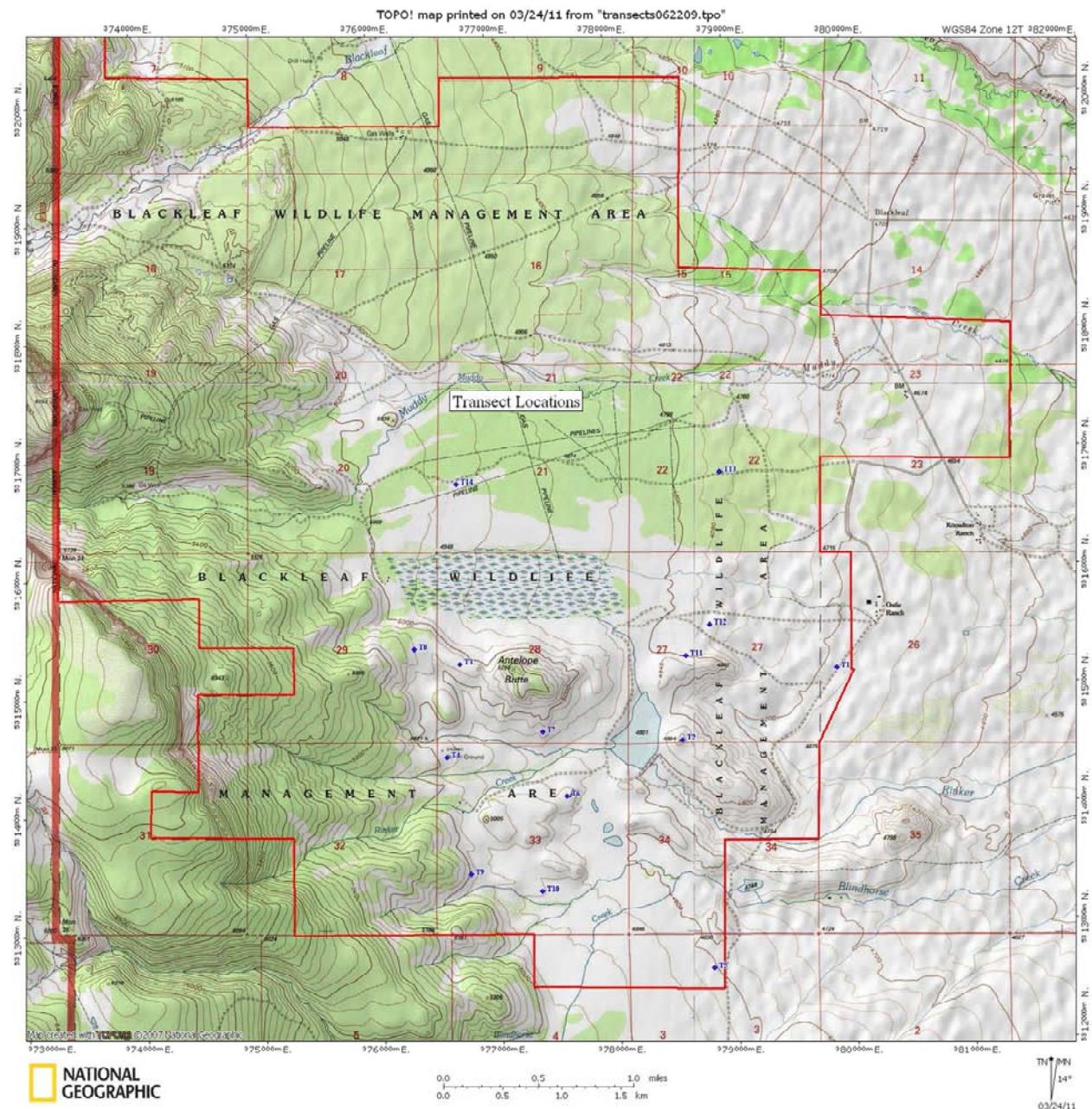


Blackleaf WMA Grazing Units



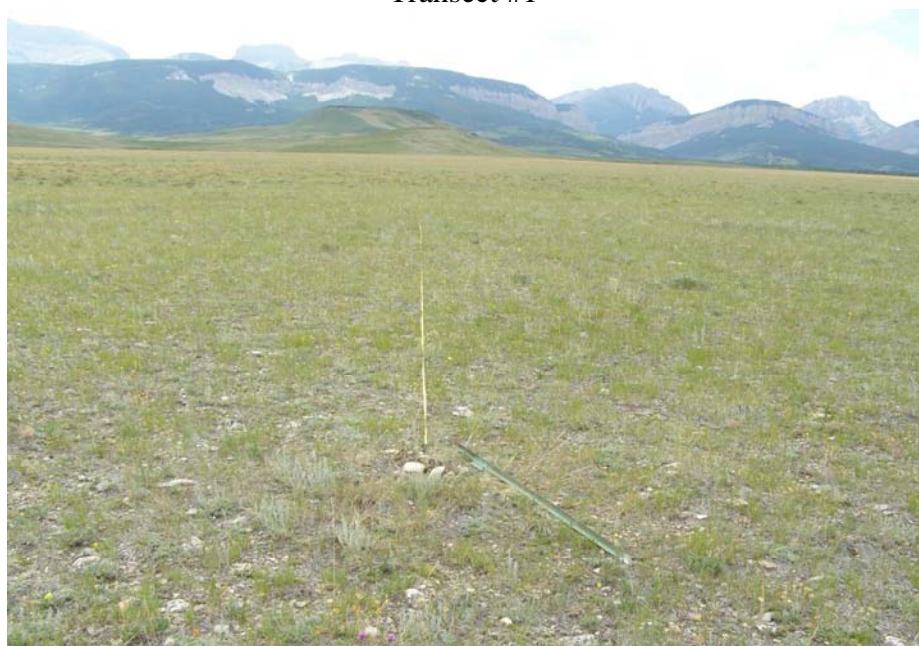
Appendix 2.

Blackleaf WMA Vegetation Transect Locations

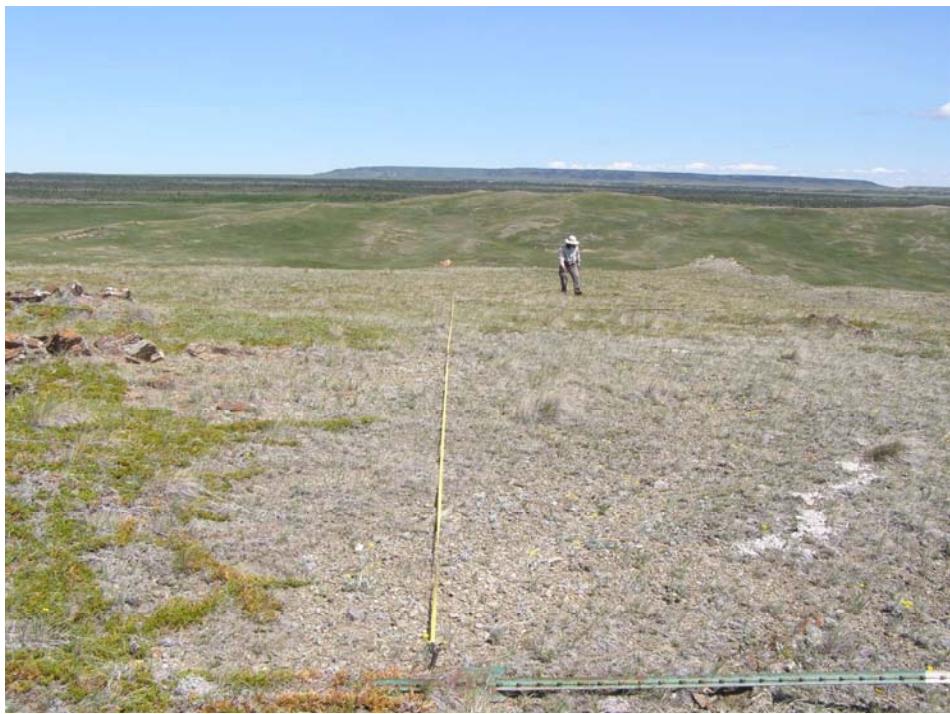
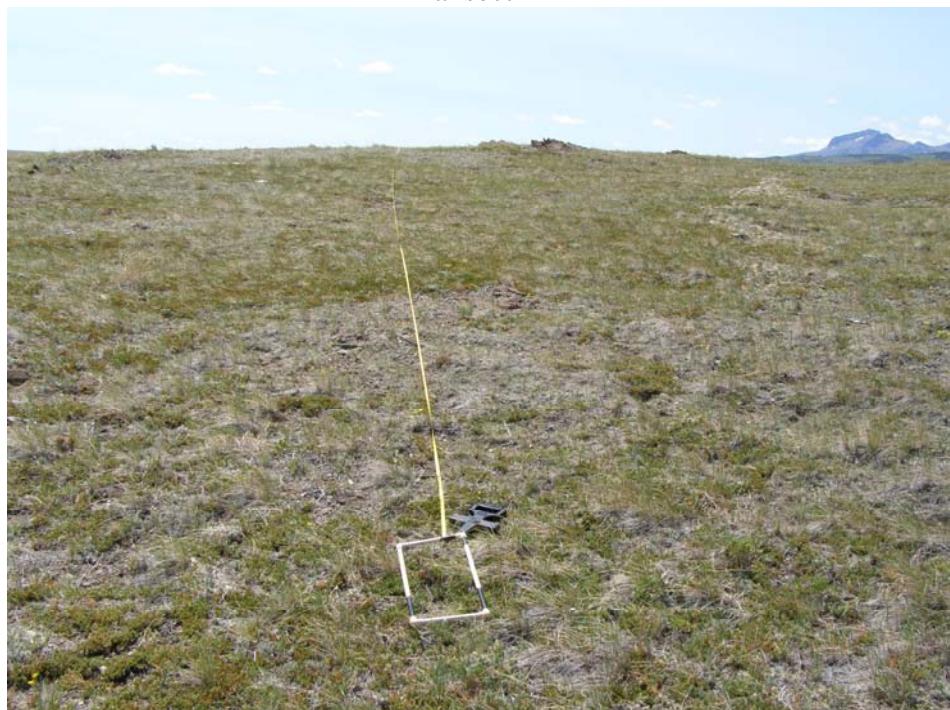


Blackleaf Wildlife Management Area Vegetation Transect Locations			
Transect #	GPS Coord. - UTM		Site Description
1	12T - 0379875	5315150	SW Ostle buildings, just west of trail - runs west
2	12T - 0378560	5314563	On hill east of Lake - runs north
3	12T - 0376692	5315238	West of Antelope Butte - runs SW toward Ear Mtn
4	12T - 0376567	5314449	Graveyard/battle site area, just east of travois trail 25 yds. - runs east
5	12T - 0378793	5312629	SE corner of WMA - runs west
6	12T - 0377576	5314108	Hill south of Rinker Creek and Antelope Butte - runs south toward Dry Coulee Notch
7	12T - 0377382	5314652	South face of Antelope Butte - runs north, uphill
8	12T - 0376308	5315375	West of Antelope Butte, west of Old North Trail in limber pine - runs ssw
9	12T - 0376750	5313463	Clark Fork Muddy Creek, east facing slope - runs sw along contour of hill
10	12T - 0377353	5313310	east of #9 on terrace between two drainanges - runs nw toward Mt Frazier
11	12T - 0378607	5315278	east of Antelope Butte on north facing hill - runs wsw slightly uphill
12	12T - 0378811	5315529	On flat area south of H fence brace - 75 yards south of trail leading up to east end of swamp
13	12T - 0378911	5316825	North side of Muddy Creek Road - runs east
14	12T - 0376685	5316770	South side Muddy creek Road - runs south

Transect #1



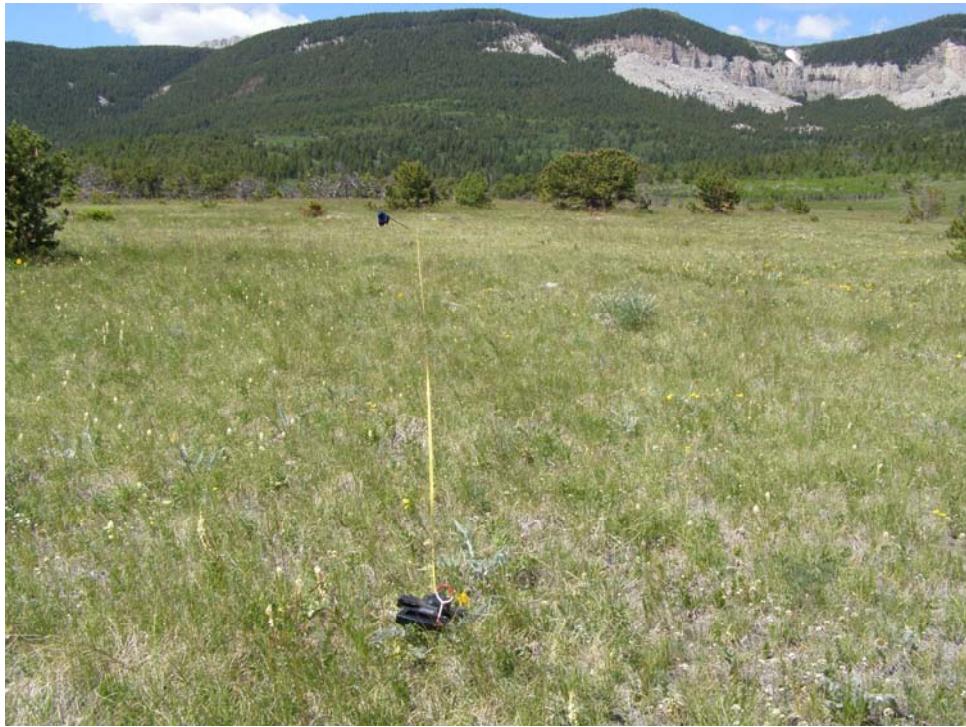
Transect #2



Transect #3



Transect #4



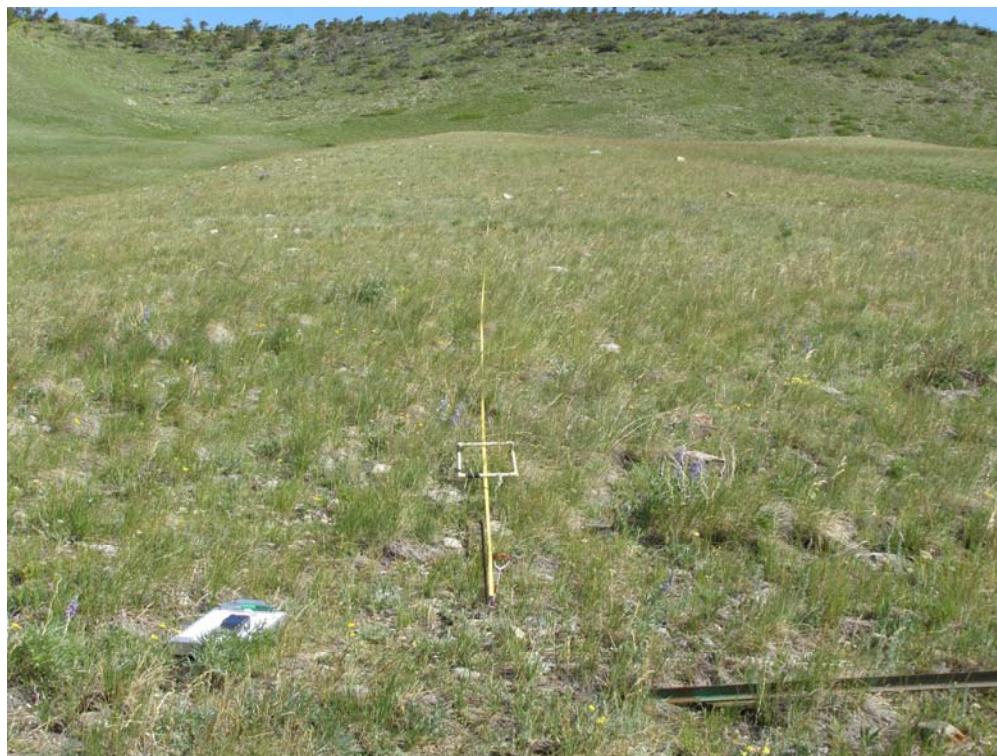
Transect #5



Transect #6



Transect #7



Transect #8



Transect #9



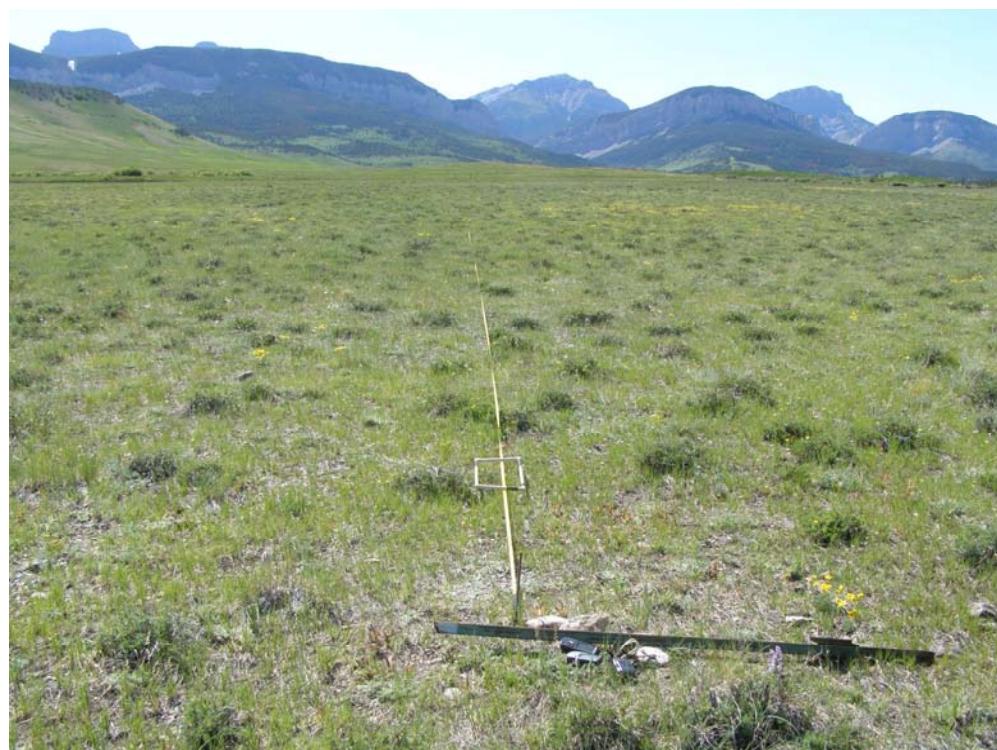
Transect #10



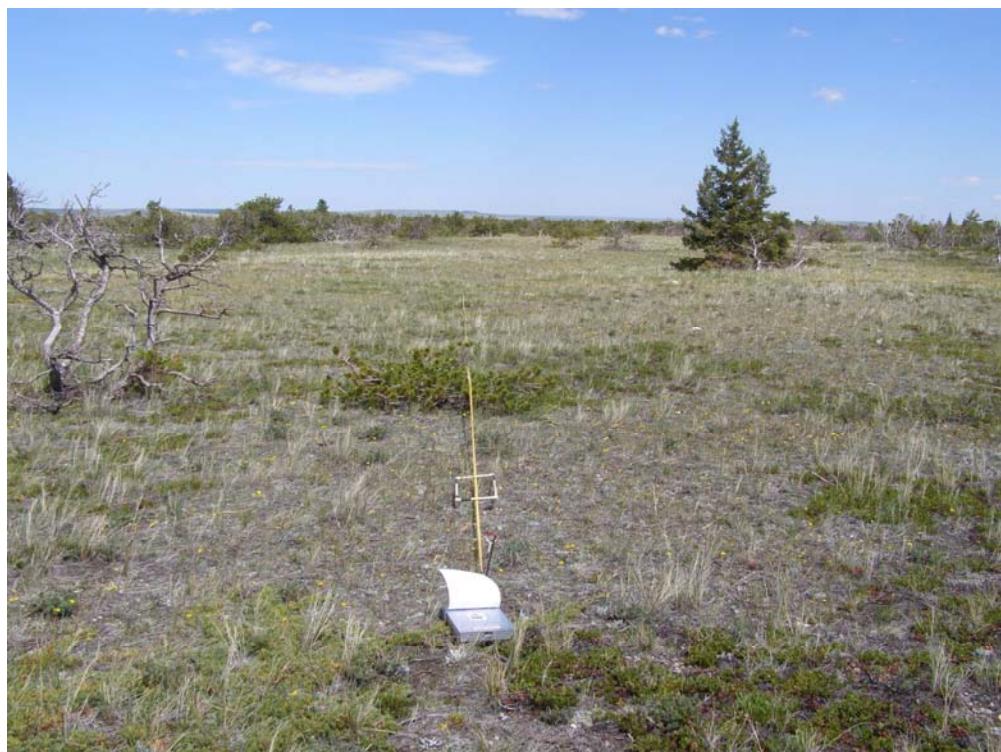
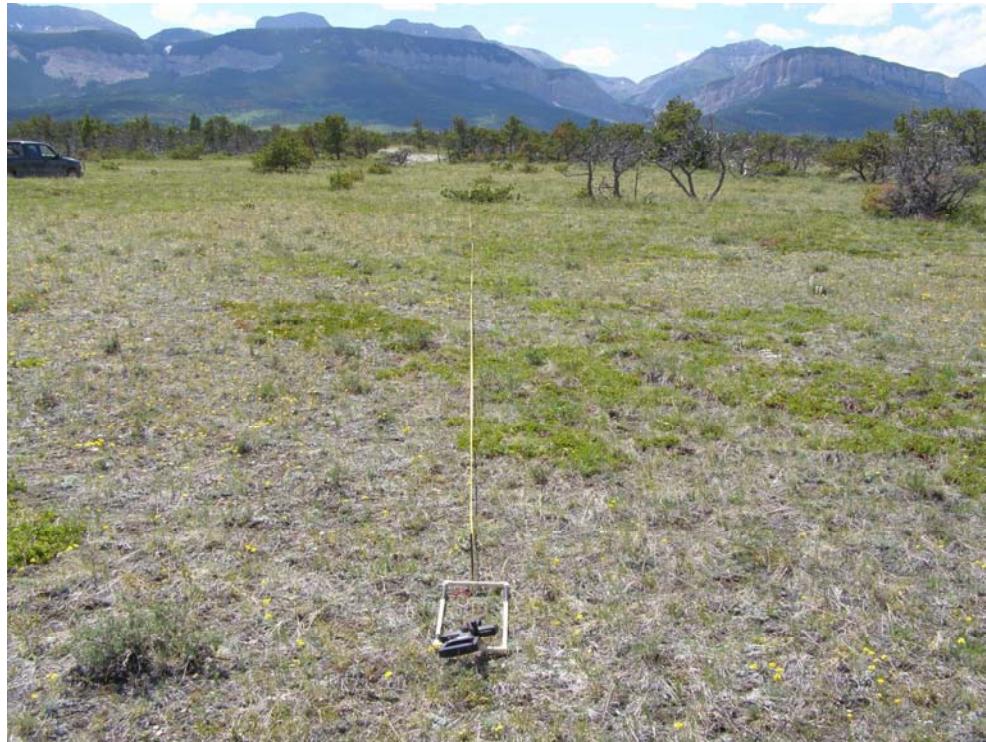
Transect 11



Transect #12



Transect#13

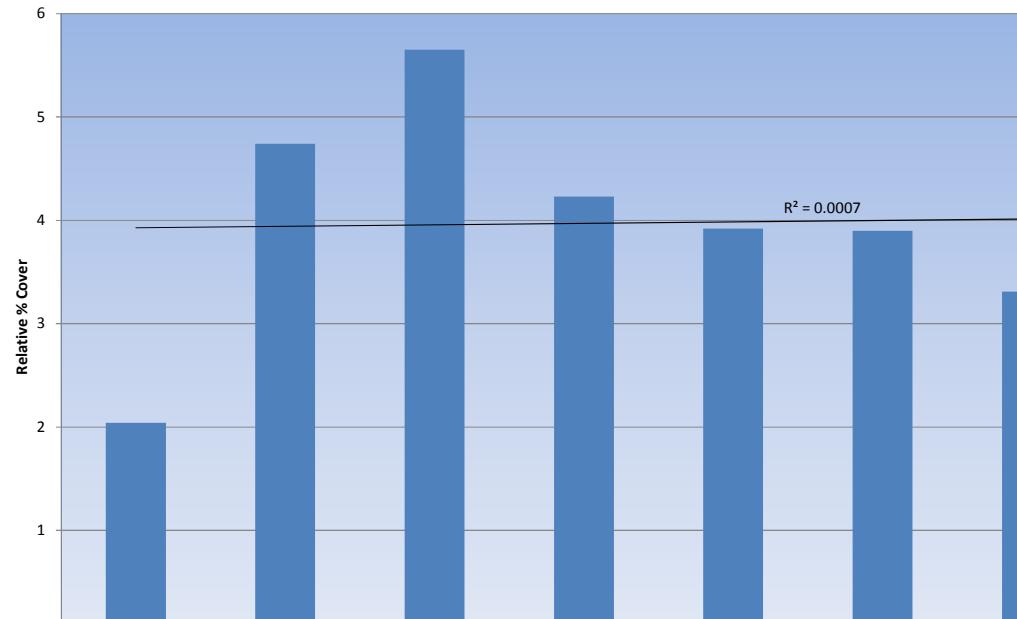


Transect #14

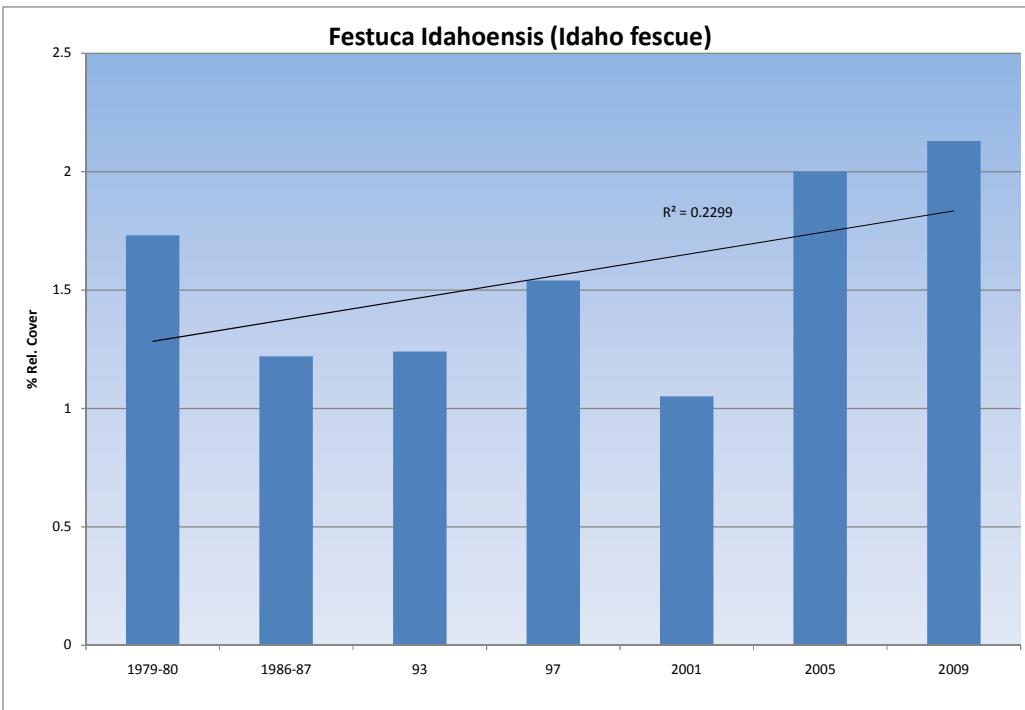


Appendix 3.

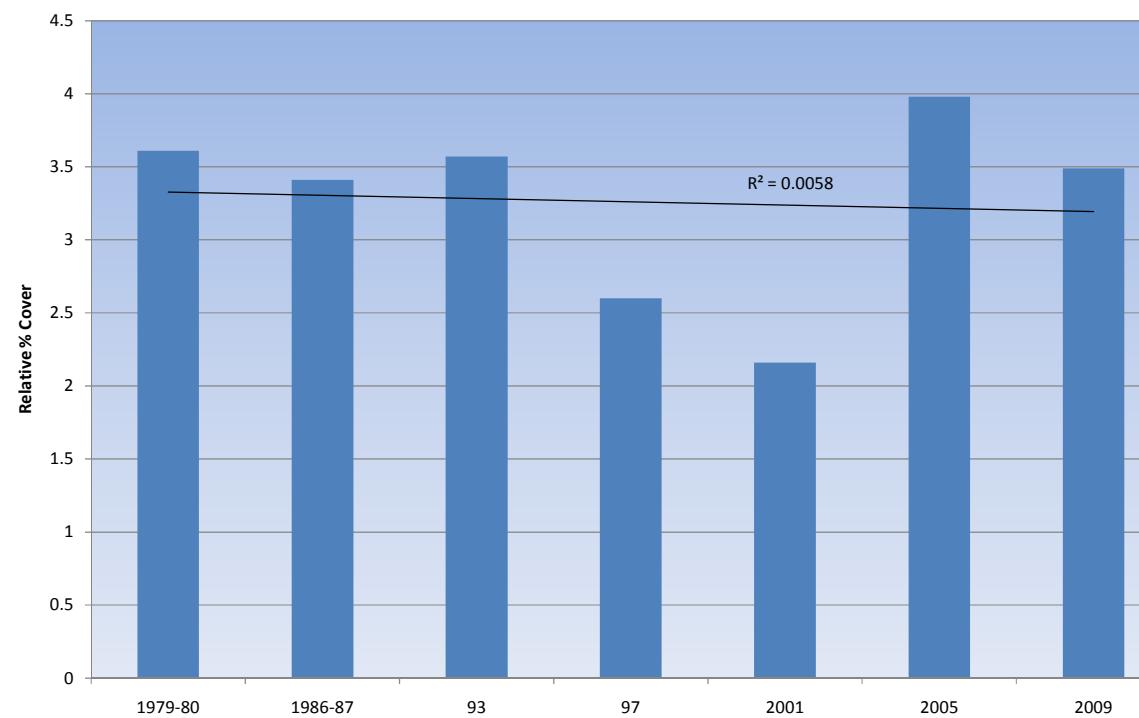
Danthonia Parryii (Parry oatgrass)



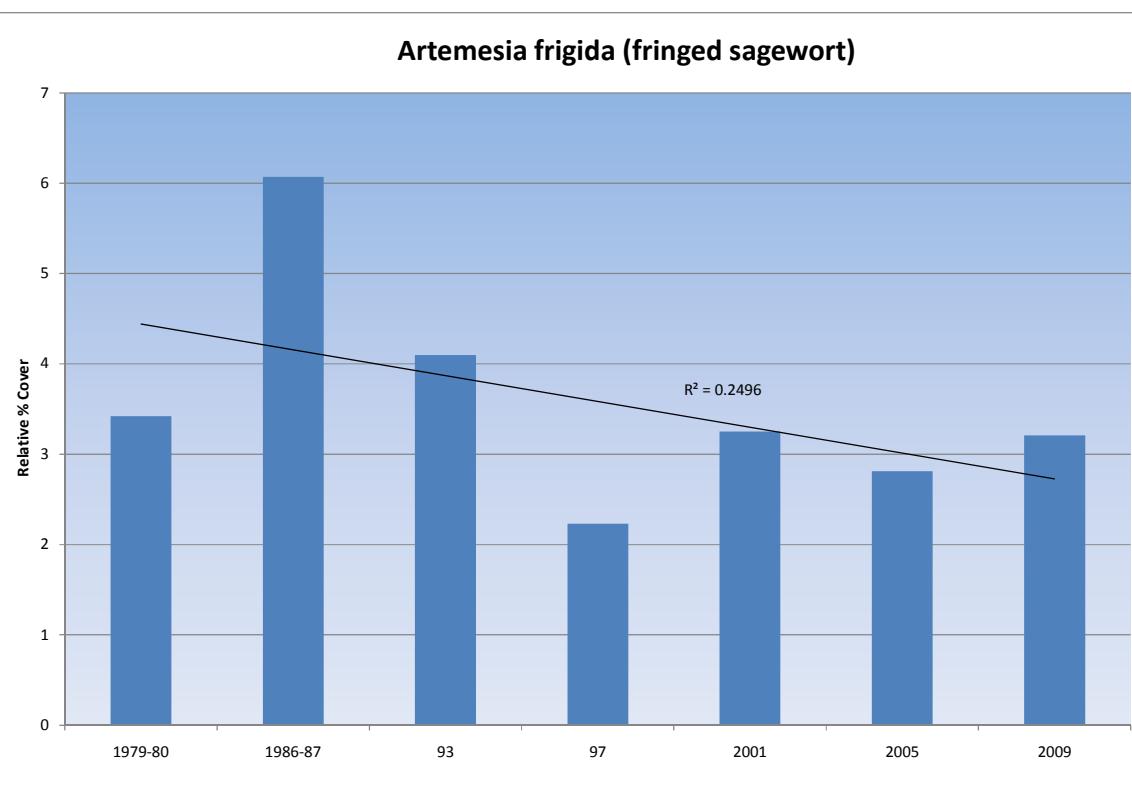
Festuca Idahoensis (Idaho fescue)

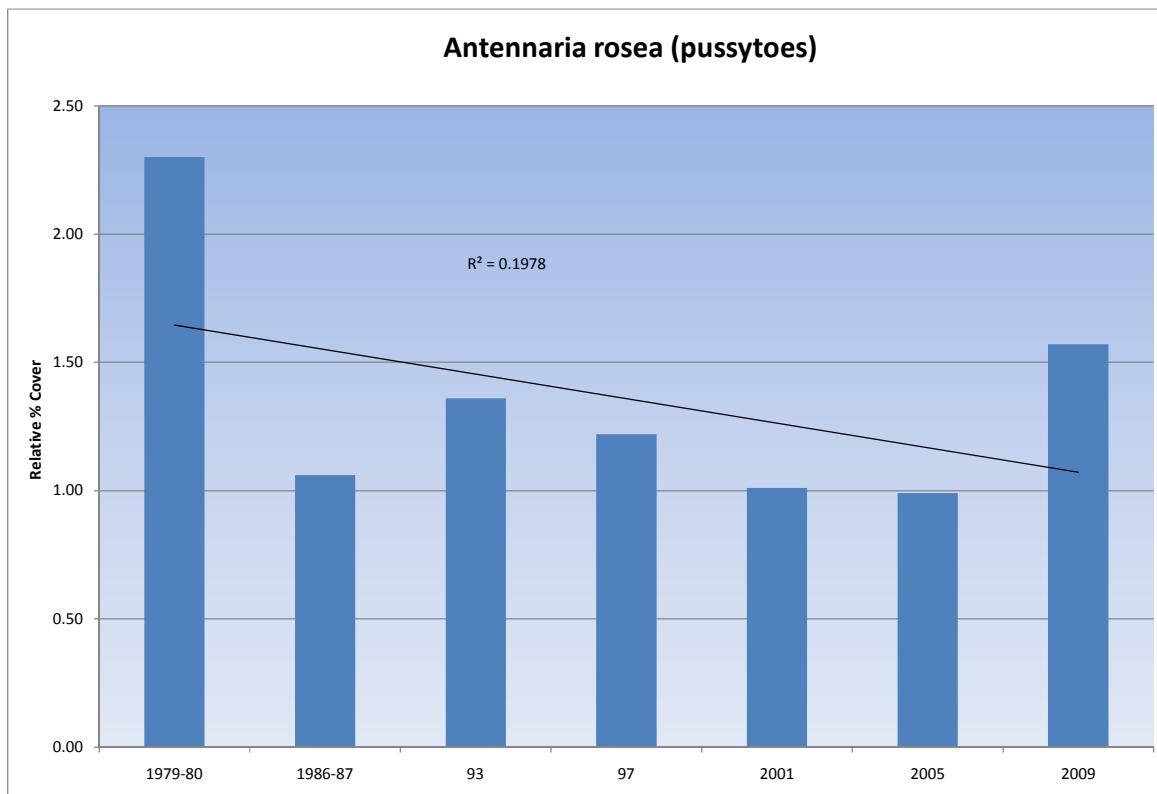
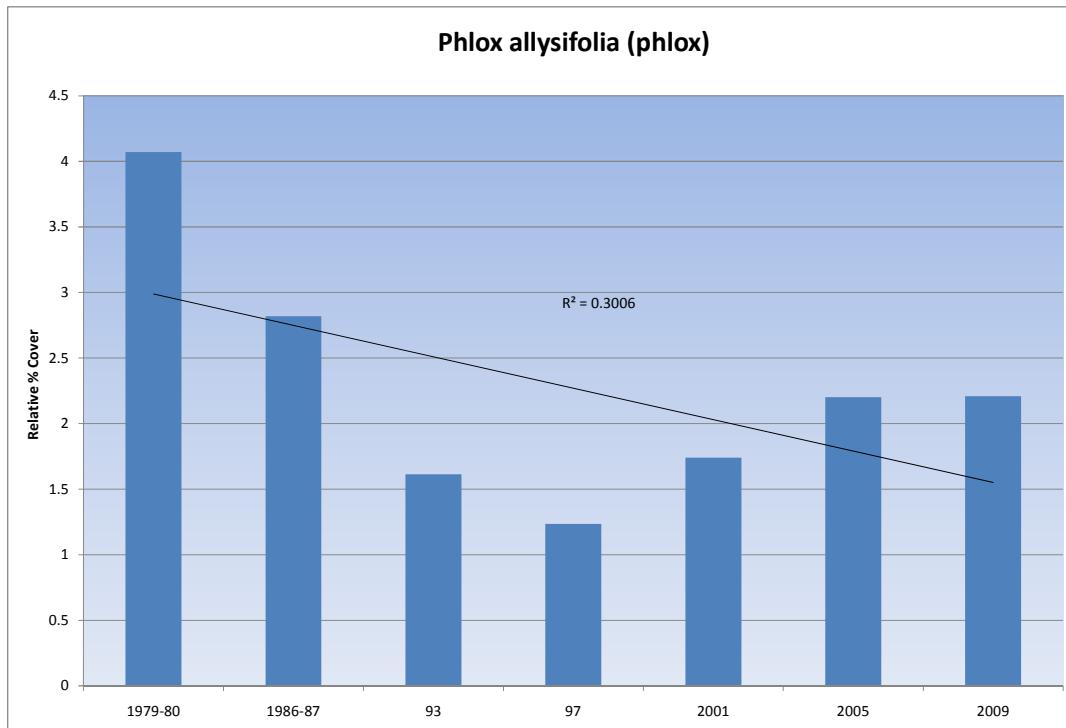


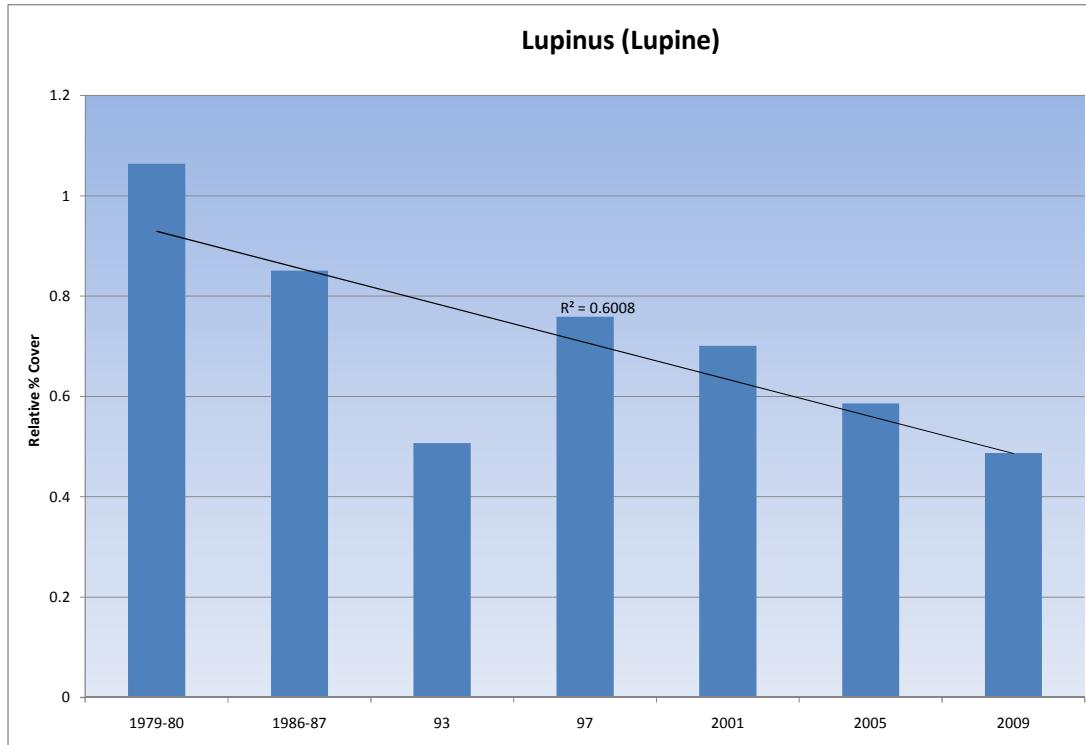
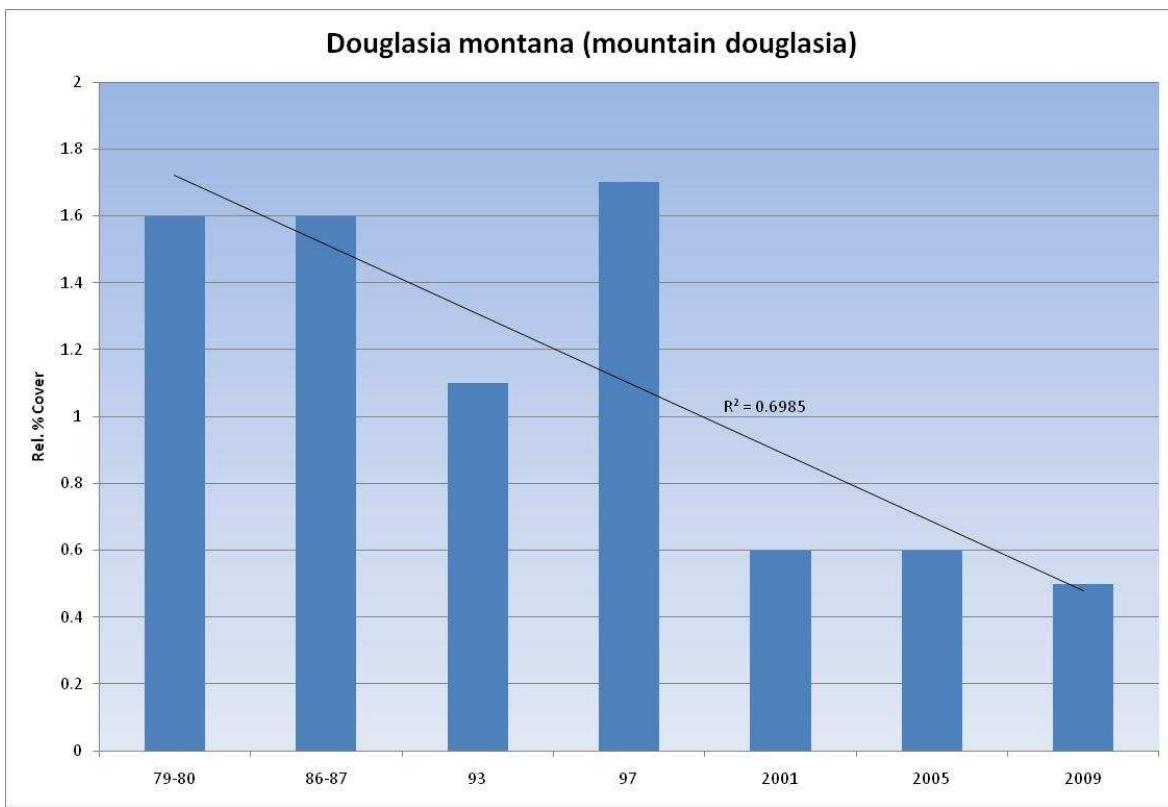
Koeleria cristata (prairie junegrass)

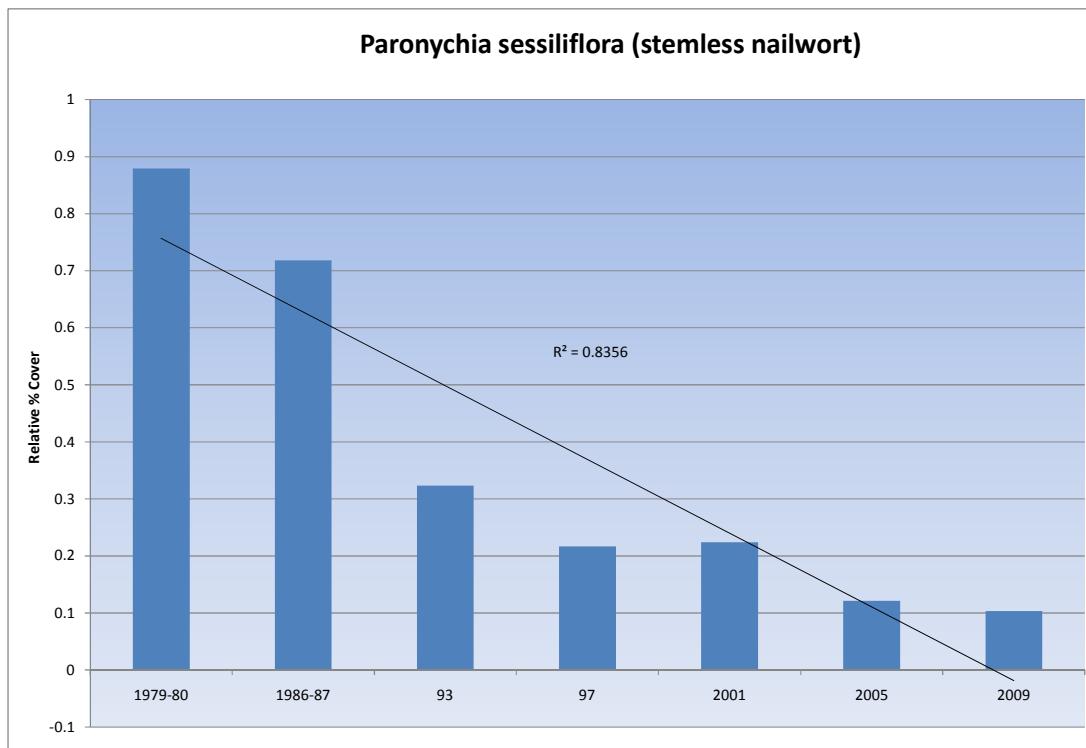
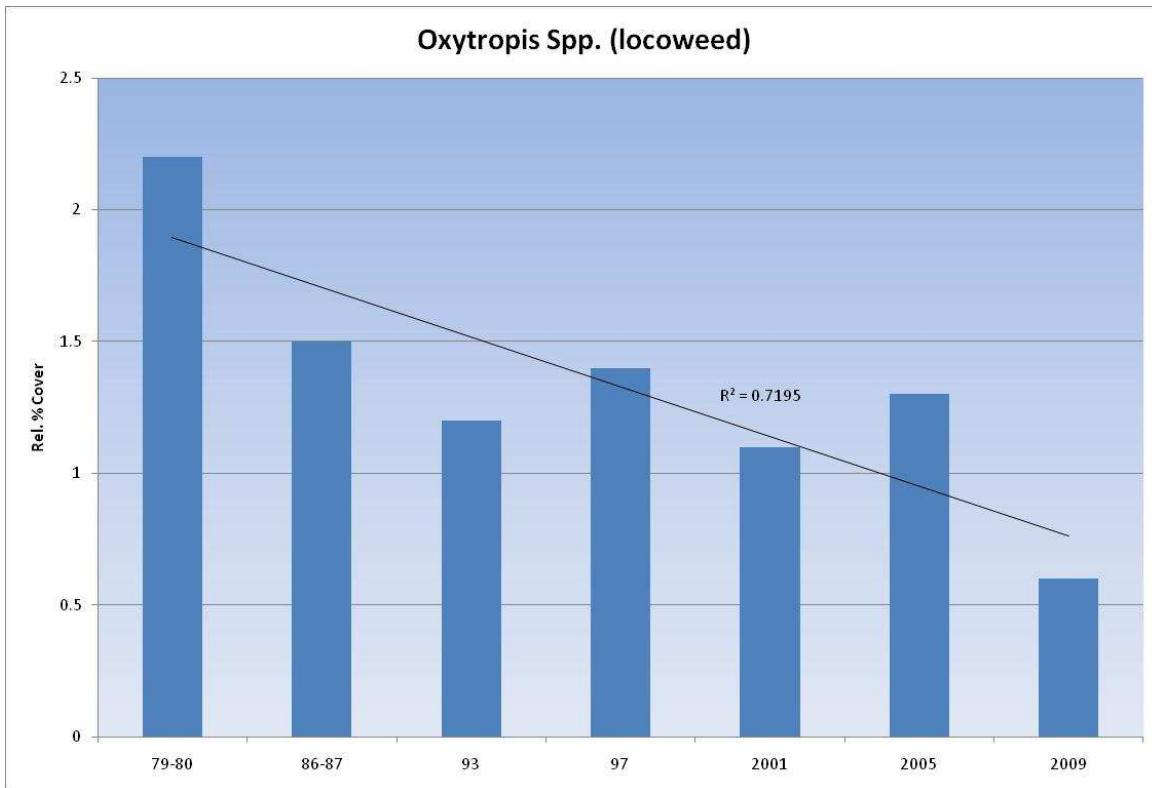


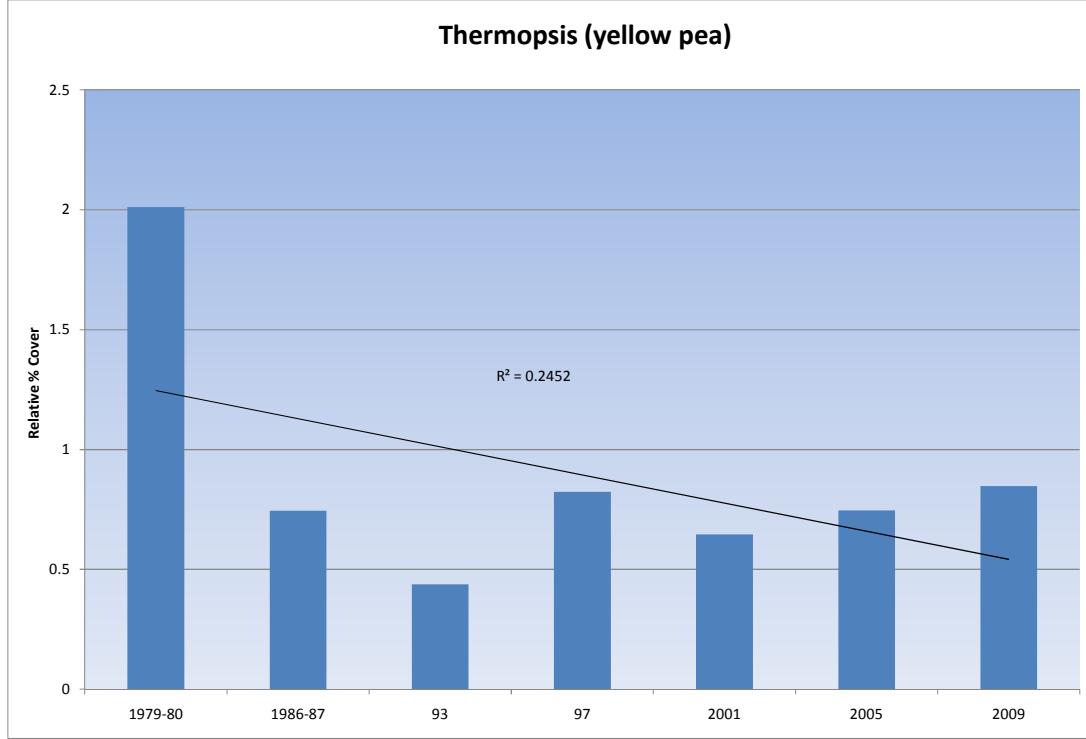
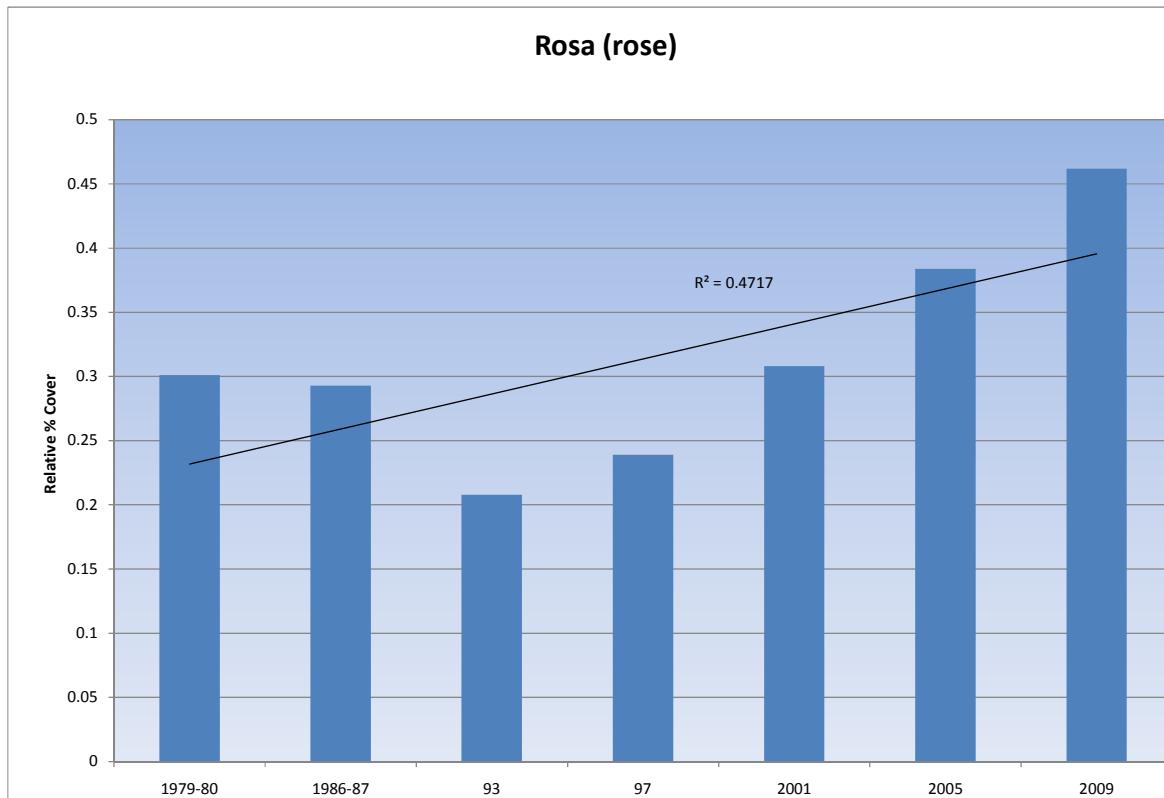
Artemesia frigida (fringed sagewort)











Appendix 4. Blackleaf WMA Range Transects - Basal Cover Values																
		T1	T2	T3	T4	T5	T6	T7*	T8*	T9*	T10	T11	T12	T13*	T14*	Total
Species	Year	%														
All	79-80	24.82	44.30	23.75	30.55	64.13	30.20	44.10	52.90	42.40	41.80	70.00	24.00	42.80	69.50	43.23
	86-87	27.80	44.28	25.15	27.00	55.08	36.30	41.13	51.10	32.83	39.10	53.18	19.58	36.68	37.05	37.59
	93	28.18	44.45	34.25	34.63	55.45	42.85	37.93	54.58	31.93	40.35	56.83	23.93	53.58	68.20	43.37
	97	28.85	53.31	29.63	38.87	60.14	41.91	43.79	56.87	40.58	34.17	61.86	32.73	50.25	72.24	46.09
	2001	25.65	38.04	26.04	27.62	34.59	32.17	33.44	55.96	31.23	39.00	47.78	21.92	40.43	45.35	35.66
	2005	38.18	60.41	46.35	36.33	45.93	49.99	45.50	76.55	44.30	44.45	69.17	36.51	50.29	49.24	49.51
	2009	29.48	43.13	31.65	32.65	40.18	36.82	31.25	68.21	37.38	43.41	52.65	25.20	31.28	41.91	38.94
Grasses	79-80	7.18	8.20	9.95	10.15	11.68	6.23	12.20	11.25	15.40	15.80	8.65	12.00	7.30	4.08	10.01
	86-87	8.21	7.27	14.89	13.58	15.50	8.64	12.79	14.86	18.85	19.96	8.36	9.60	6.68	2.97	11.58
	93	9.50	7.26	22.04	17.69	14.21	11.07	16.09	13.55	23.43	29.30	7.83	10.66	8.19	4.82	13.97
	97	10.73	9.07	16.81	21.65	12.37	10.58	18.66	10.44	31.55	24.20	8.22	11.53	9.48	5.55	14.35
	2001	10.21	8.43	15.91	16.95	12.61	11.30	15.13	11.89	24.76	28.73	7.56	6.26	7.14	5.56	13.03
	2005	16.06	12.60	26.10	18.45	17.40	16.53	22.95	17.90	30.35	33.25	13.98	19.65	12.93	8.43	19.04
	2009	10.00	8.53	18.75	16.35	15.70	12.50	18.15	14.61	23.50	31.00	10.20	11.90	6.40	6.98	14.61
Forbs	79-80	17.64	36.10	13.80	20.40	52.45	23.97	31.90	41.65	27.00	26.00	61.35	12.00	35.50	65.42	33.23
	86-87	19.59	37.01	10.26	13.42	39.58	27.66	28.34	36.24	13.98	19.14	44.82	9.98	30.00	34.08	26.01
	93	18.74	37.03	11.90	16.80	41.32	31.79	21.88	41.06	8.26	11.15	49.00	13.56	45.54	63.09	29.37
	97	18.12	44.24	12.82	17.22	47.77	31.48	25.13	46.43	9.03	9.97	53.64	21.20	40.77	66.69	31.75
	2001	15.44	29.61	10.13	10.67	21.98	20.87	18.31	44.07	6.47	10.27	40.22	15.66	33.29	39.79	22.63
	2005	22.12	47.81	20.25	17.88	28.53	33.46	22.55	58.65	13.95	11.20	55.19	16.86	37.36	40.81	30.47
	2009	19.48	34.60	12.90	16.30	24.28	24.32	13.10	53.60	13.88	12.41	42.45	13.30	24.88	34.93	24.32
Agsp	79-80	0.80	0.50	0.00	0.10	1.50	0.03	1.70	0.60	1.80	1.60	0.80	0.00	0.90	1.10	0.82
	86-87	0.85	0.15	0.05	0.03	0.58	0.00	1.33	0.28	0.40	1.85	0.45	0.00	0.98	1.23	0.58
	93	0.65	0.10	0.05	0.00	0.23	0.00	0.00	0.18	0.08	0.00	0.30	0.00	0.98	1.68	0.30
	97	1.05	0.18	0.00	0.00	0.20	0.00	0.00	0.10	0.05	0.05	0.15	0.00	1.35	1.00	0.30
	2001	0.43	0.00	0.00	0.00	0.18	0.00	0.35	0.25	0.20	0.00	0.00	0.00	1.20	1.00	0.26
	2005	1.10	0.05	0.00	0.00	1.55	0.00	1.50	0.35	0.05	0.05	0.55	0.00	1.50	2.35	0.65
	2009	0.63	0.05	0.00	0.05	0.75	0.00	1.00	0.55	0.50	0.00	0.55	0.00	0.60	1.85	0.47
Agropyron spp	79-80	0.08	1.30	0.00	0.10	0.10	1.20	1.20	0.00	1.50	1.30	1.70	3.60	0.20	0.30	0.90
	86-87	0.08	1.23	0.00	0.00	0.08	1.30	1.55	0.50	1.00	1.10	1.65	5.10	0.03	0.18	0.99
	93	0.08	0.90	0.00	0.00	0.15	0.48	2.50	0.13	0.45	1.00	0.78	4.33	0.08	0.08	0.78
	97	0.13	0.70	0.05	0.15	0.05	1.00	3.23	0.35	3.25	0.45	0.68	3.85	0.20	0.40	1.04
	2001	0.10	0.55	0.00	0.05	0.20	0.40	0.35	0.03	0.53	0.40	0.20	1.30	0.08	0.23	0.32
	2005	0.18	1.35	0.00	0.00	0.15	0.98	1.00	0.20	0.70	1.10	1.20	7.55	0.05	0.15	1.04
	2009	0.05	0.33	0.00	0.10	0.23	0.80	1.90	0.05	1.25	0.90	0.65	4.70	0.10	0.15	0.80
Cafi	79-80	0.30	1.20	0.10	0.05	0.00	0.10	1.50	0.60	0.30	0.60	1.60	0.00	0.00	0.30	0.48
	86-87	0.25	0.00	0.18	0.05	0.15	0.05	0.50	0.10	0.00	0.00	0.00	0.00	0.00	0.05	0.10
	93	0.15	1.30	0.00	0.00	0.10	0.15	1.00	0.35	0.00	0.00	0.00	0.00	0.00	0.05	0.22
	97	0.35	1.50	0.00	0.00	0.10	0.00	2.00	0.20	0.00	0.05	0.25	0.00	0.00	0.35	0.34
	2001	0.65	2.25	0.05	0.10	0.10	0.00	1.35	0.00	0.15	0.00	0.80	0.00	0.00	0.08	0.40
	2005	0.25	4.05	0.05	0.00	0.05	0.00	0.75	0.60	0.00	0.05	0.83	0.00	0.00	0.05	0.48
	2009	0.25	2.10	0.05	0.25	0.00	0.05	0.65	0.25	0.00	0.00	1.50	0.00	0.00	0.05	0.37

		T1	T2	T3	T4	T5	T6	T7*	T8*	T9*	T10	T11	T12	T13*	T14*	Total
Species	Year	%														
Carex spp	79-80	0.00	0.55	0.05	1.45	1.53	0.00	0.35	0.05	0.18	0.70	1.25	0.50	1.60	0.10	0.59
	86-87	0.00	2.87	0.00	1.80	2.23	0.00	0.53	1.75	0.05	0.05	2.57	0.10	2.33	0.10	1.03
	93	0.00	0.28	0.03	0.73	0.90	0.03	0.23	0.95	0.00	0.10	0.85	0.03	1.45	0.08	0.40
	97	0.00	1.08	0.13	0.85	1.45	0.20	0.25	1.08	0.00	0.00	1.33	0.33	2.38	0.40	0.68
	2001	0.00	1.23	0.43	1.10	1.50	0.15	0.00	0.90	0.10	0.28	1.23	0.15	1.65	0.25	0.64
	2005	0.00	1.60	0.00	1.20	2.15	0.00	0.00	0.00	0.00	0.00	2.35	0.00	2.45	0.25	0.71
	2009	0.00	1.20	0.00	1.05	1.30	0.00	0.85	0.25	0.00	0.00	1.30	0.05	1.00	0.30	0.52
Dapa	79-80	0.00	0.00	4.70	1.30	2.40	0.20	0.00	2.30	1.40	0.00	0.00	0.00	0.00	0.00	0.88
	86-87	0.00	0.00	9.75	5.80	4.75	0.03	0.00	4.55	0.05	0.00	0.00	0.00	0.00	0.00	1.78
	93	0.00	0.25	17.50	7.80	3.50	0.10	0.00	5.23	0.00	0.00	0.00	0.00	0.00	0.00	2.45
	97	0.00	0.00	11.25	9.25	4.53	0.05	0.00	2.15	0.00	0.00	0.00	0.00	0.00	0.00	1.95
	2001	0.00	0.00	7.10	7.10	4.15	0.30	0.00	0.98	0.03	0.00	0.00	0.00	0.00	0.00	1.40
	2005	0.00	0.00	12.50	6.35	2.45	2.00	0.00	3.70	0.00	0.00	0.00	0.00	0.05	0.00	1.93
	2009	0.00	0.00	7.00	4.85	3.90	0.25	0.00	2.05	0.00	0.00	0.00	0.00	0.00	0.00	1.29
Feid	79-80	0.00	0.00	1.90	1.70	3.10	0.00	0.30	4.70	5.30	5.50	0.60	0.00	1.10	0.00	1.73
	86-87	0.00	0.00	0.53	0.80	1.30	0.00	0.50	3.85	5.75	3.40	0.40	0.00	0.50	0.00	1.22
	93	0.00	0.00	1.35	2.43	3.15	0.10	0.00	1.15	3.60	3.90	0.50	0.00	1.20	0.00	1.24
	97	0.00	0.05	1.15	4.15	1.73	0.25	0.25	1.83	3.35	7.25	0.35	0.00	1.25	0.00	1.54
	2001	0.00	0.05	0.50	1.95	1.88	0.05	0.35	1.20	2.70	4.55	0.60	0.00	0.90	0.00	1.05
	2005	0.00	0.25	3.00	2.95	2.95	0.10	0.25	2.80	4.55	6.80	2.80	0.00	1.60	0.00	2.00
	2009	0.00	0.25	3.05	4.00	2.70	0.05	0.05	3.00	6.10	8.05	0.95	0.00	1.60	0.00	2.13
Fesc	79-80	1.25	0.90	1.80	1.30	3.00	1.40	2.30	0.90	2.10	3.20	1.20	0.00	1.10	1.70	1.58
	86-87	4.50	2.03	4.13	4.65	5.85	3.30	3.50	2.60	6.10	11.05	3.45	0.00	1.13	0.75	3.79
	93	5.13	2.00	2.50	3.55	6.05	5.40	4.55	4.73	10.30	21.00	4.25	0.00	2.08	1.83	5.24
	97	4.25	3.70	3.63	5.15	4.00	5.60	8.10	5.98	10.80	15.30	4.55	0.00	2.70	2.20	5.43
	2001	5.05	3.20	7.55	6.20	4.45	7.30	10.05	8.20	17.50	23.50	4.10	0.00	2.38	2.55	7.29
	2005	5.65	3.60	10.35	7.70	7.40	10.35	15.35	9.80	18.00	25.00	5.05	0.00	4.35	4.03	9.05
	2009	3.60	2.15	7.65	5.75	5.70	8.20	8.85	7.95	16.50	21.75	3.25	0.00	1.85	3.45	6.90
Kocr	79-80	1.90	3.00	0.60	1.50	0.00	1.80	2.90	0.60	0.80	1.40	0.80	4.60	1.40	0.50	1.56
	86-87	1.25	0.78	0.25	0.45	0.38	2.33	3.10	0.90	1.25	1.80	1.38	2.45	0.98	0.63	1.28
	93	1.33	2.25	0.45	0.60	0.13	3.68	5.10	0.50	0.35	0.40	1.00	3.30	1.45	1.10	1.55
	97	2.30	1.60	0.60	2.00	0.23	2.18	1.70	0.05	0.00	0.00	0.45	3.30	1.20	1.20	1.20
	2001	0.60	1.00	0.28	0.35	0.15	2.70	1.15	0.25	0.05	0.00	0.55	1.48	0.75	1.45	0.77
	2005	4.65	3.15	0.25	0.20	0.60	2.85	2.65	0.30	0.05	0.25	1.15	6.85	2.75	1.85	1.97
	2009	1.25	2.25	0.95	0.55	0.85	2.85	2.80	0.25	0.05	0.05	1.85	3.15	1.10	1.15	1.36
Muhlenbergia	79-80	2.35	0.00	0.00	0.05	0.00	1.10	1.80	0.00	0.00	0.60	0.00	2.30	0.80	0.00	0.64
spp	86-87	1.25	0.00	0.00	0.00	0.00	1.53	1.50	0.00	0.00	0.28	0.00	1.95	0.48	0.00	0.50
	93	2.13	0.00	0.00	0.03	0.00	0.80	2.53	0.00	0.00	0.00	0.00	3.00	0.55	0.00	0.65
	97	2.35	0.00	0.00	0.00	0.00	0.85	2.98	0.00	0.00	0.00	0.00	3.95	0.25	0.00	0.74
	2001	3.23	0.00	0.00	0.00	0.00	0.40	1.43	0.00	0.00	0.00	0.00	3.05	0.18	0.00	0.59
	2005	4.30	0.00	0.00	0.00	0.00	0.25	1.45	0.00	0.00	0.00	0.00	5.00	0.18	0.00	0.80
	2009	3.80	0.00	0.00	0.00	0.00	0.05	1.45	0.00	0.00	0.00	0.00	3.85	0.05	0.00	0.66

		T1	T2	T3	T4	T5	T6	T7*	T8*	T9*	T10	T11	T12	T13*	T14*	Total
Species	Year	%														
Anenome spp	79-80	0.00	0.10	0.50	0.50	0.50	0.03	0.00	1.30	0.00	0.60	1.70	0.00	0.00	0.40	0.40
	86-87	0.00	0.10	0.18	0.28	0.35	0.03	0.00	0.43	0.00	0.13	0.60	0.00	0.00	0.48	0.18
	93	0.00	0.05	0.30	0.18	0.28	0.05	0.00	0.33	0.00	0.13	1.03	0.00	0.03	0.40	0.20
	97	0.00	0.38	0.30	0.13	0.13	0.05	0.00	0.38	0.00	0.30	0.80	0.00	0.00	0.70	0.23
	2001	0.00	0.20	0.38	0.10	0.60	0.10	0.00	0.40	0.00	0.35	0.60	0.00	0.03	0.33	0.22
	2005	0.00	0.30	0.65	0.20	0.45	0.10	0.00	0.85	0.00	0.60	1.15	0.00	0.00	0.50	0.34
	2009	0.00	0.60	0.60	0.45	0.95	0.10	0.00	0.60	0.05	1.10	1.30	0.00	0.05	0.55	0.45
Anro	79-80	0.00	0.00	0.00	0.30	0.50	0.05	0.30	2.30	2.60	4.40	0.30	1.30	1.50	0.50	1.00
	86-87	0.00	0.00	0.05	0.05	0.55	0.00	0.25	0.70	0.50	0.70	0.05	1.00	1.25	0.55	0.40
	93	0.00	0.00	0.55	1.15	0.80	0.25	0.30	0.45	0.75	1.65	0.00	0.75	0.90	0.75	0.59
	97	0.00	0.00	0.18	1.45	0.80	0.25	0.10	0.10	0.60	1.75	0.00	1.00	1.00	0.55	0.56
	2001	0.00	0.00	0.00	0.00	0.00	0.10	0.30	0.00	0.05	1.65	0.00	1.50	0.65	0.75	0.36
	2005	0.00	0.25	0.05	0.00	1.50	0.30	0.30	0.00	1.05	2.05	0.00	0.05	0.00	1.25	0.49
	2009	0.00	0.05	0.00	0.75	1.50	0.05	0.30	0.05	1.75	2.10	0.00	0.05	0.85	1.05	0.61
Arenaria spp	79-80	0.00	0.00	1.00	0.50	1.00	0.50	0.00	0.70	2.60	0.90	0.20	0.00	1.10	0.00	0.61
	86-87	0.00	0.00	0.38	0.65	0.08	0.33	0.00	0.20	0.35	0.30	0.08	0.08	1.23	0.00	0.26
	93	0.00	0.00	0.43	0.73	0.03	0.38	0.00	0.35	0.10	0.23	0.00	0.00	0.65	0.00	0.21
	97	0.00	0.00	0.83	1.65	0.28	0.48	0.00	0.05	0.35	0.38	0.05	0.00	0.35	0.00	0.32
	2001	0.00	0.00	0.48	1.15	0.08	0.23	0.00	0.00	0.03	0.20	0.00	0.00	0.55	0.00	0.19
	2005	0.00	0.00	1.70	0.60	0.20	0.70	0.00	0.00	0.00	0.10	0.00	0.00	0.25	0.00	0.25
	2009	0.00	0.00	2.00	1.45	0.25	0.10	0.00	0.20	0.05	0.35	0.00	0.00	0.25	0.00	0.33
Arfr	79-80	1.50	1.00	0.60	0.60	0.60	1.90	5.40	0.00	3.00	3.70	1.00	1.10	0.30	0.00	1.48
	86-87	2.20	2.38	0.30	0.30	0.40	3.38	7.60	0.00	4.25	5.95	2.40	1.80	0.98	0.00	2.28
	93	5.40	2.40	0.65	0.55	0.33	3.00	3.10	0.00	2.15	3.65	1.68	1.20	0.75	0.00	1.78
	97	4.45	0.68	0.10	0.15	0.10	1.20	2.65	0.00	0.75	0.60	0.40	2.98	0.38	0.00	1.03
	2001	3.90	0.53	0.10	0.05	0.55	1.15	2.73	0.00	0.23	1.20	0.30	5.20	0.30	0.00	1.16
	2005	4.25	1.95	0.00	0.00	0.75	1.10	4.40	0.00	0.30	1.25	0.55	4.65	0.30	0.00	1.39
	2009	6.65	0.85	0.05	0.00	0.75	0.55	1.60	0.00	0.30	1.40	0.15	4.90	0.30	0.00	1.25
Cear	79-80	0.90	0.30	0.50	0.40	0.60	0.10	0.70	0.40	0.40	1.50	0.60	0.50	0.50	0.00	0.53
	86-87	0.88	0.08	0.53	1.23	0.13	0.20	0.15	2.15	1.33	3.35	0.43	0.45	0.23	0.00	0.80
	93	0.80	0.15	0.40	0.48	0.60	0.48	1.23	0.03	0.50	0.08	0.63	2.18	0.58	0.00	0.58
	97	0.95	0.08	0.33	0.75	0.25	0.45	0.58	0.13	0.10	0.00	0.18	2.00	0.48	0.00	0.45
	2001	0.30	0.00	0.33	0.35	0.00	0.53	0.15	0.05	0.00	0.05	0.05	0.03	0.05	0.00	0.14
	2005	1.00	0.15	2.30	2.45	0.05	1.08	0.15	0.95	0.00	0.00	0.50	0.00	0.80	0.13	0.68
	2009	0.25	0.28	0.55	2.40	0.13	0.10	0.05	0.50	0.00	0.40	0.30	0.00	0.55	0.15	0.40
Chvi	79-80	0.10	0.00	0.05	0.10	0.00	0.20	0.05	0.30	0.00	0.50	0.30	0.00	0.10	0.00	0.12
	86-87	0.05	0.00	0.03	0.05	0.00	0.68	0.10	0.35	0.00	0.00	0.15	0.00	0.10	0.00	0.11
	93	0.05	0.00	0.23	0.03	0.03	0.45	0.10	0.13	0.00	0.00	0.35	0.00	0.15	0.00	0.11
	97	0.05	0.00	0.55	0.00	0.00	0.25	0.20	0.30	0.00	0.00	0.55	0.00	0.13	0.00	0.15
	2001	0.15	0.00	0.15	0.00	0.00	0.00	0.10	0.08	0.00	0.00	0.10	0.00	0.00	0.00	0.04
	2005	0.10	0.00	0.25	0.00	0.00	0.00	0.30	0.15	0.00	0.00	0.55	0.00	0.00	0.00	0.10
	2009	0.05	0.00	0.15	0.00	0.00	0.00	0.30	0.05	0.00	0.00	0.05	0.00	0.05	0.00	0.05

		T1	T2	T3	T4	T5	T6	T7*	T8*	T9*	T10	T11	T12	T13*	T14*	Total
Species	Year	%														
Coum (commandra)	79-80	0.20	0.05	0.30	0.80	0.10	0.30	0.40	0.05	0.30	0.80	0.20	0.00	0.00	0.00	0.25
	86-87	0.13	0.13	0.13	0.53	0.08	0.28	0.18	0.10	0.05	0.28	0.08	0.00	0.05	0.00	0.14
	93	0.05	0.08	0.15	0.33	0.03	0.35	0.08	0.05	0.10	0.35	0.10	0.00	0.10	0.00	0.13
	97	0.03	0.55	0.33	0.33	0.10	0.23	0.30	0.15	0.00	0.00	0.15	0.00	0.00	0.00	0.16
	2001	0.05	0.28	0.10	0.35	0.15	0.18	0.23	0.00	0.00	0.05	0.08	0.00	0.10	0.00	0.11
	2005	0.25	0.80	0.15	0.80	0.10	0.30	0.30	0.05	0.10	0.00	0.70	0.00	0.08	0.00	0.26
	2009	0.00	0.20	0.55	1.15	0.08	0.25	0.10	0.10	0.25	0.00	0.40	0.00	0.05	0.00	0.22
Domo	79-80	0.00	2.20	0.90	0.40	0.03	2.90	0.00	0.00	0.00	0.00	3.10	0.00	0.10	0.00	0.69
	86-87	0.00	1.28	0.30	0.90	0.28	2.65	0.00	0.00	0.00	0.00	2.80	0.00	0.00	0.00	0.59
	93	0.00	0.80	0.00	0.18	0.50	2.53	0.00	0.00	0.00	0.00	2.80	0.00	0.00	0.00	0.49
	97	0.00	2.70	1.05	0.00	0.50	3.60	0.00	0.00	0.00	0.00	2.88	0.00	0.00	0.00	0.77
	2001	0.03	0.90	0.30	0.00	0.00	1.38	0.00	0.00	0.00	0.00	0.53	0.00	0.00	0.00	0.22
	2005	0.00	1.08	0.30	0.30	0.00	1.90	0.25	0.00	0.00	0.00	0.80	0.00	0.00	0.00	0.33
	2009	0.00	0.33	0.15	0.10	0.00	1.43	0.00	0.00	0.00	0.00	0.55	0.00	0.00	0.00	0.18
Erca (fuzzy)	79-80	0.60	0.10	0.00	1.75	0.05	1.10	0.60	0.30	0.80	0.80	0.40	0.03	0.30	0.10	0.50
	86-87	0.08	0.53	0.38	0.43	0.05	1.95	0.40	0.25	1.05	1.40	0.28	0.05	0.40	0.05	0.52
	93	0.85	0.20	0.68	1.00	0.13	2.25	0.28	0.00	0.00	0.88	0.65	0.58	0.25	0.05	0.56
	97	0.88	0.15	0.85	0.25	0.15	1.85	0.15	0.05	0.05	0.25	0.58	1.20	0.50	0.35	0.52
	2001	0.60	0.20	0.00	0.00	0.05	0.55	0.30	0.00	0.00	0.00	0.25	0.50	0.95	0.10	0.25
	2005	0.60	0.15	0.55	0.10	0.50	0.35	0.05	0.00	0.00	0.00	1.15	0.55	1.30	0.25	0.40
	2009	0.25	0.00	0.00	0.20	0.00	0.05	0.00	0.05	0.00	0.90	0.60	0.55	0.45	0.00	0.22
Eroc (long-leaf)	79-80	0.40	0.20	0.05	0.20	0.00	0.30	0.20	0.00	0.03	0.03	0.10	0.00	0.10	0.00	0.12
	86-87	0.18	0.50	0.03	0.15	0.00	0.43	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.10
	93	0.08	0.05	0.08	0.15	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.00	0.05
	97	0.30	0.25	0.10	0.05	0.00	0.10	0.10	0.00	0.00	0.00	0.00	0.10	0.15	0.05	0.09
	2001	0.13	0.25	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.15	0.00	0.04
	2005	0.33	0.05	0.00	0.00	0.00	0.50	0.05	0.00	0.00	0.00	0.00	0.00	0.40	0.00	0.10
	2009	0.15	0.00	0.00	0.00	0.00	0.15	0.05	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.03
Gabo	79-80	0.00	0.10	0.50	0.70	0.20	0.05	0.00	0.75	0.45	0.00	1.40	0.00	0.80	0.05	0.36
	86-87	0.00	0.03	0.68	0.08	0.28	0.08	0.00	0.43	0.00	0.00	0.25	0.00	0.28	0.00	0.15
	93	0.00	0.03	0.38	0.08	0.05	0.10	0.00	0.25	0.05	0.00	0.05	0.00	0.23	0.05	0.09
	97	0.00	0.10	0.48	0.15	0.28	0.33	0.00	0.43	0.05	0.00	0.48	0.00	0.53	0.15	0.21
	2001	0.00	0.00	0.70	0.30	0.05	0.60	0.00	0.23	0.60	0.00	0.28	0.00	0.25	0.05	0.22
	2005	0.00	0.30	1.30	0.60	0.15	0.50	0.00	0.60	0.75	0.00	0.40	0.00	0.23	0.20	0.36
	2009	0.00	0.05	1.00	0.20	0.20	0.00	0.00	0.15	1.05	0.00	0.35	0.00	0.48	0.05	0.36
Hyac	79-80	1.70	0.70	0.50	0.90	0.05	0.30	2.30	0.00	0.00	0.00	0.30	0.00	2.20	0.70	0.69
	86-87	3.00	0.98	0.68	1.25	0.00	0.10	1.53	0.00	0.00	0.00	0.00	0.00	1.75	0.65	0.71
	93	3.40	0.65	0.65	1.03	0.00	0.30	1.15	0.00	0.00	0.00	0.30	0.00	2.25	0.60	0.74
	97	2.25	0.95	0.15	0.65	0.00	0.10	1.30	0.00	0.00	0.00	0.15	0.00	1.50	0.40	0.53
	2001	3.15	1.08	0.10	0.60	0.05	0.20	0.50	0.00	0.00	0.00	0.03	0.00	1.18	0.65	0.54
	2005	4.18	1.65	0.30	0.80	0.00	0.20	0.25	0.00	0.00	0.00	0.00	0.00	1.65	0.55	0.68
	2009	3.35	0.88	0.10	0.60	0.00	0.25	0.45	0.00	0.00	0.00	0.05	0.00	1.45	0.30	0.53

		T1	T2	T3	T4	T5	T6	T7*	T8*	T9*	T10	T11	T12	T13*	T14*	Total
Species	Year	%														
Juho	79-80	0.00	15.10	0.00	0.00	27.80	2.00	2.50	6.30	0.00	0.00	29.50	0.00	0.50	0.00	5.98
	86-87	0.00	18.80	0.00	0.00	24.35	4.55	1.75	15.50	0.00	0.00	27.25	0.00	0.05	0.25	6.61
	93	0.00	23.00	0.00	0.75	35.30	10.75	6.75	23.50	0.00	0.00	30.55	0.00	0.30	0.30	9.37
	97	0.00	26.05	0.00	2.50	41.00	12.55	7.75	30.35	0.00	0.00	36.50	0.00	1.10	1.00	11.34
	2001	0.00	21.50	0.00	2.00	16.50	7.05	8.00	34.00	0.00	0.00	32.75	0.00	1.80	2.00	8.97
	2005	0.00	28.30	0.00	2.75	20.80	12.05	5.50	43.25	0.00	0.00	37.75	0.00	1.00	1.05	10.89
	2009	0.00	24.55	0.05	1.50	18.05	12.60	1.60	43.00	0.00	0.00	29.95	0.00	0.25	1.25	9.49
Lipu	79-80	0.20	0.00	0.40	0.60	0.00	0.05	0.30	0.00	0.00	0.80	0.05	0.00	0.10	0.00	0.18
	86-87	0.33	0.00	0.50	0.38	0.00	0.33	0.63	0.00	0.00	1.28	0.00	0.00	0.30	0.00	0.27
	93	0.48	0.00	0.45	0.50	0.00	0.35	0.25	0.00	0.00	0.78	0.10	0.00	0.15	0.00	0.22
	97	0.55	0.00	0.68	0.35	0.00	0.28	0.88	0.00	0.00	0.75	0.05	0.00	0.30	0.00	0.27
	2001	0.95	0.00	0.98	0.90	0.00	0.40	1.10	0.00	0.00	1.15	0.05	0.00	0.40	0.00	0.42
	2005	0.45	0.00	1.90	0.90	0.00	0.65	0.90	0.00	0.00	1.00	0.00	0.00	0.35	0.00	0.44
	2009	0.50	0.00	0.75	0.40	0.00	0.45	0.95	0.00	0.00	0.40	0.05	0.00	0.05	0.00	0.25
Lupinus spp	79-80	0.00	1.10	0.60	0.30	0.90	1.60	0.05	0.90	0.05	0.70	0.20	0.00	0.00	0.00	0.46
	86-87	0.00	0.05	0.15	0.18	1.10	1.10	0.85	0.13	0.00	0.83	0.05	0.00	0.00	0.00	0.32
	93	0.00	0.15	0.58	0.10	0.55	0.40	0.10	0.10	0.15	0.53	0.40	0.00	0.00	0.00	0.22
	97	0.00	0.98	0.18	0.00	0.33	0.68	0.30	0.23	0.25	1.35	0.60	0.00	0.00	0.00	0.35
	2001	0.00	0.13	0.20	0.18	0.45	0.50	0.15	0.40	0.05	1.03	0.35	0.00	0.00	0.00	0.25
	2005	0.00	0.40	0.35	0.30	0.40	1.10	0.00	0.05	0.35	0.60	0.45	0.00	0.00	0.00	0.29
	2009	0.00	0.05	0.65	0.10	0.15	0.35	0.25	0.35	0.05	0.38	0.30	0.00	0.00	0.00	0.19
Oxytropis spp	79-80	0.25	2.75	0.20	1.10	0.30	1.30	3.40	0.90	0.00	0.05	1.80	0.20	0.85	0.20	0.95
	86-87	1.00	0.55	0.00	0.05	0.10	0.05	3.18	0.25	0.00	1.50	0.00	0.00	0.55	0.70	0.57
	93	0.78	0.96	0.05	0.45	1.06	0.35	1.50	0.10	0.10	0.65	0.10	0.00	0.58	0.90	0.54
	97	0.55	1.73	0.10	0.33	1.30	0.65	2.46	0.00	0.05	1.00	0.63	0.00	0.00	0.00	0.63
	2001	0.30	0.55	0.05	0.05	1.03	0.40	0.75	0.05	0.25	1.18	0.15	0.05	0.10	0.35	0.38
	2005	1.10	2.05	0.10	0.35	1.20	0.60	1.30	0.30	0.00	1.10	0.15	0.25	0.25	0.05	0.63
	2009	0.10	0.48	0.50	0.05	0.15	0.05	0.00	0.00	0.00	1.10	0.00	0.00	0.00	0.65	0.22
Phal	79-80	1.30	1.20	0.20	0.80	0.05	7.60	2.50	0.30	0.50	1.90	5.20	0.00	0.80	2.30	1.76
	86-87	0.95	0.95	0.05	0.35	0.00	5.80	1.80	0.00	0.05	0.58	2.55	0.00	0.53	1.28	1.06
	93	1.08	1.15	0.00	0.23	0.00	3.50	1.90	0.05	0.00	0.00	0.88	0.00	0.23	0.83	0.70
	97	2.25	0.95	0.15	0.65	0.00	0.10???	1.30	0.00	0.00	0.00	0.15	0.00	1.50	0.40	0.57
	2001	2.08	0.63	0.00	0.15	0.05	3.85	0.90	0.00	0.00	0.00	0.18	0.00	0.15	0.65	0.62
	2005	3.55	0.70	0.00	0.35	0.05	6.10	2.00	0.00	0.00	0.00	1.35	0.00	0.10	1.05	1.09
	2009	3.25	0.75	0.00	0.50	0.05	3.80	1.15	0.00	0.00	0.00	1.55	0.00	0.15	0.90	0.86
Phho	79-80	4.00	7.70	3.40	7.80	0.10	0.30	6.60	3.00	2.90	1.70	6.10	0.00	1.40	0.00	3.21
	86-87	5.55	6.88	3.25	5.55	0.40	0.50	4.25	1.30	0.85	1.80	1.55	0.00	1.05	0.00	2.35
	93	2.88	4.95	2.90	6.45	0.18	0.50	3.00	1.65	0.00	0.10	0.75	0.00	0.68	0.05	1.72
	97	3.15	5.23	3.43	5.70	0.15	0.05	3.45	0.30	0.00	0.00	0.58	0.00	0.28	0.00	1.59
	2001	2.20	1.90	3.45	3.15	0.00	0.05	2.10	0.53	0.00	0.00	0.18	0.00	0.10	0.00	0.98
	2005	3.80	3.45	4.10	3.65	0.05	0.50	3.60	0.30	0.00	0.00	0.25	0.00	0.75	0.05	1.46
	2009	3.70	4.05	2.20	3.35	0.08	0.25	2.95	0.00	0.00	0.00	0.65	0.00	0.40	0.05	1.26

		T1	T2	T3	T4	T5	T6	T7*	T8*	T9*	T10	T11	T12	T13*	T14*	Total
Species	Year	%														
Pofr	79-80	0.00	0.00	0.60	0.00	0.00	0.50	1.00	15.30	0.00	0.80	4.00	6.10	5.30	0.50	2.44
	86-87	0.00	0.00	0.55	0.00	0.00	0.90	2.00	10.00	0.00	0.10	2.85	4.15	5.25	1.00	1.91
	93	0.00	0.03	1.05	0.00	0.00	1.65	0.05	10.40	0.00	0.50	4.15	6.33	3.55	0.75	2.03
	97	0.00	0.03	0.60	0.00	0.00	1.10	0.75	6.65	0.00	0.50	3.20	8.35	3.55	0.50	1.80
	2001	0.00	0.05	0.55	0.00	0.00	0.90	0.50	5.95	0.05	0.30	2.30	5.25	3.35	1.00	1.44
	2005	0.00	0.00	2.00	0.00	0.00	1.85	1.50	8.45	0.25	1.00	5.30	8.80	5.00	1.25	2.53
	2009	0.00	0.00	0.50	0.00	0.00	1.55	1.00	4.40	0.05	1.25	1.90	5.15	1.80	0.80	1.31
Potentilla	79-80	0.50	0.05	0.20	0.05	0.00	0.30	0.10	0.00	0.40	0.05	0.10	0.70	0.00	0.00	0.18
	spp.	0.00	0.00	0.05	0.00	0.00	0.30	0.50	0.00	0.00	0.10	0.05	0.45	0.00	0.00	0.10
	93	0.05	0.03	0.08	0.03	0.00	0.05	0.23	0.00	0.05	0.10	0.00	0.45	0.00	0.00	0.08
	97	0.00	0.40	0.10	0.25	0.00	0.60	0.55	6.65???	0.10	0.25	3.33???	1.80	0.00	0.00	0.34
	2001	0.00	0.00	0.10	0.00	0.00	0.25	0.15	0.00	0.05	0.65	0.00	1.45	0.00	0.00	0.19
	2005	0.00	0.00	0.35	0.00	0.00	0.35	0.75	0.00	0.05	0.10	0.15	0.45	0.00	0.00	0.16
	2009	0.00	0.00	0.15	0.00	0.00	0.15	0.55	0.00	0.05	0.05	0.10	0.20	0.00	0.00	0.09
Rosa	79-80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.40	1.00	0.00	0.00	0.00	0.30	0.13
	86-87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30	0.65	0.25	0.00	0.05	0.00	0.35	0.11
	93	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.15	0.28	0.60	0.05	0.05	0.00	0.10	0.09
	97	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.15	0.70	0.45	0.05	0.05	0.00	0.15	0.11
	2001	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.15	0.40	0.80	0.05	0.05	0.00	0.08	0.11
	2005	0.00	0.00	0.05	0.00	0.00	0.00	0.05	0.40	1.10	0.90	0.05	0.00	0.00	0.10	0.19
	2009	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.20	1.00	1.15	0.05	0.00	0.00	0.10	0.18
Seca	79-80	0.50	0.10	0.10	0.30	0.03	0.50	0.30	0.00	0.00	0.00	0.05	0.10	1.30	0.20	0.25
	86-87	1.60	0.30	0.15	0.15	0.00	1.45	0.23	0.00	0.00	0.00	0.25	0.15	0.80	0.40	0.39
	93	0.40	0.45	0.23	0.65	0.03	0.70	0.10	0.00	0.00	0.00	0.05	0.05	0.65	0.50	0.27
	97	0.35	1.00	0.15	0.05	0.00	0.40	0.10	0.00	0.00	0.00	0.05	0.25	0.40	0.70	0.25
	2001	0.10	0.23	0.18	0.05	0.30	0.35	0.00	0.00	0.50	0.00	0.00	0.20	0.33	0.60	0.20
	2005	0.25	1.30	0.30	0.25	0.25	0.30	0.00	0.00	0.00	0.00	0.00	0.05	1.05	1.08	0.35
	2009	0.15	0.50	0.15	0.40	0.05	0.20	0.00	0.00	0.00	0.00	0.05	0.00	0.10	0.75	0.17
Thrh	79-80	0.00	0.00	0.30	0.60	0.70	0.20	0.00	0.00	9.80	0.00	0.60	0.00	0.00	0.00	0.87
	86-87	0.00	0.00	0.05	0.25	0.78	0.15	0.00	0.08	1.95	0.00	0.70	0.00	0.00	0.00	0.28
	93	0.00	0.00	0.20	0.40	0.28	0.18	0.00	0.13	0.80	0.05	0.60	0.00	0.00	0.00	0.19
	97	0.00	0.00	0.40	0.40	0.90	0.40	0.00	0.05	2.40	0.00	0.78	0.00	0.00	0.00	0.38
	2001	0.00	0.00	0.50	0.48	0.48	0.35	0.00	0.15	0.50	0.00	0.80	0.00	0.00	0.00	0.23
	2005	0.00	0.00	0.90	1.05	0.58	0.85	0.00	0.00	0.95	0.00	0.83	0.00	0.00	0.00	0.37
	2009	0.00	0.00	0.35	0.60	0.40	0.60	0.00	0.10	1.90	0.00	0.60	0.00	0.00	0.05	0.33

* indicates ungrazed transect

Appendix 5. Commonly Occuring Plant Species List - Blackleaf WMA (1979 - 2009)

Common Name	Genus/species	Code	Notes
Grasses			
bluebunch wheatgrass	<i>Agropyron spicatum</i>	Agsp	
wheatgrasses	<i>Agropyron</i> spp.	Agssp	<i>Agropyron smithii</i> , <i>Agropyron dasystachyum</i> were combined
threadleaf sedge	<i>Carex filifolia</i>	Cafi	
sedges	<i>Carex</i> spp	Carex spp	<i>Carex eleocharis</i> , <i>Carex heliophila</i> were combined
Parry oatgrass	<i>Danthonia parryi</i>	Dapa	
Idaho fescue	<i>Festuca idahoensis</i>	Feid	
rough fescue	<i>Festuca scabrella</i>	Fesc	
prairie junegrass	<i>Koeleria cristata</i>	Kocr	
Forbs/Shrubs			
Muhly	<i>Muhlenbergia</i> spp.	Mu spp	<i>Muhlenbergia cuspidata</i> , <i>Muhlenbergia richardsonis</i> were combined
pasque flower	<i>Anenome patens</i>	Anpa	
pussy toes	<i>Antennaria rosea</i>	Anro	
sandwort	<i>Arenaria</i> spp.	Arenaria spp	<i>Arenaria capillaris</i> ?
fringed sagewort	<i>Artemesia frigida</i>	Arfr	
chickweed	<i>Cerastium arvense</i>	Cear	
hairy gold aster	<i>Chrysopsis villosa</i>	Chvi	
bastard toadflax	<i>Commandra umbellata</i>	Coum	
mountain douglasia	<i>Douglasia montana</i>	Domo	
fuzzy daisy	<i>Erigeron caespitosus</i>	Erca	
long leaf daisy	<i>Erigeron ochroleucus</i>	Eroc	
northern bedstraw	<i>Galium boreale</i>	Gabo	
butte marigold	<i>Hymenoxys acaulis</i>	Hyac	
horizontal juniper	<i>Juniperus horizontalis</i>	Joho	
blazing star	<i>Liatris punctata</i>	Lipu	
lupine	<i>Lupinus</i> spp.	Lupinus spp	unsure of <i>Lupinus</i> species - sericeus?
loco weed	<i>Oxytropis</i> spp.	Oxy spp.	<i>Oxytropis besseyii</i> , <i>serecea</i> , <i>viscosa</i> were combined
blue phlox	<i>Phlox diffusa</i>	Phal	
moss phlox	<i>Phlox hoodii</i>	Phho	
shrubby cinquefoil	<i>Potentilla fruticosa</i>	Pofr	
potentilla	<i>Potentilla</i> spp.	Potentilla spp.	herbaceous potentilla species combined
rose	<i>Rosa</i> spp.	Rosa spp.	unsure of rosa species
prairie groundsel	<i>Senecio canus</i>	Seca	
golden bean	<i>Thermopsis rhombifolia</i>	Thr	

Appendix 6. Less Common Plant Species List - Blackleaf WMA (1979 - 2009)

Common Name	Genus/species	Code	Notes
Grasses			
plains reed grass	<i>Calamagrostis montanensis</i>	Camo	
Hooker's oat grass	<i>Helictotrichon hookeri</i>	Heho	
timothy	<i>Phleum pratense</i>	Phpr	
bluegrass	<i>Poa spp</i>	poa spp	mostly <i>Poa pratensis</i> ; minor amount of <i>cusickii</i> in 2009
needle grasses	<i>Stipa spp</i>	Stipa spp	Includes small amounts of <i>columbiana</i> , <i>richardsonii</i> , <i>spartea</i> and <i>viridula</i>
Forbs and Shrubs			
common yarrow	<i>Achillea millefolium</i>	Acmi	
false dandelion	<i>Agoseris spp</i>	Agoseris spp	
wild onion	<i>Allium spp</i>	Allium spp	
fairy candelabra	<i>Androsace septentrionalis</i>	Anse	
rock cress	<i>Arabis spp</i>	Arabis spp	
bearberry	<i>Arctostaphylos uva-ursi</i>	Aruv	
sage	<i>Artemesia spp</i>	Artemesia spp	<i>Artemesia campestris</i> ?
prairie sagewort	<i>Artemesia ludoviciana</i>	Arlu	
arnica	<i>Arnica spp</i>	Arnica spp	foothills arnica?
aster	<i>Aster spp</i>	Aster spp	
milk vetch	<i>Astragalus spp</i>	Astragalus spp	several unknown spp
cushion milk vetch	<i>Astragalus trifolius</i>	Astr	
Balsam-root	<i>Balsamorrhiza hookeri</i>	Baho	
kitten tail	<i>Besseya wyomingensis</i>	Bewy	
bupleurum	<i>Bupleurum americanum</i>	Buam	
bluebell	<i>Campanula rotundifolia</i>	Caro	
Indian paint-brush	<i>Castilleja spp</i>	Castilleja spp	
hawksbeard	<i>Crepis spp</i>	Crepis spp	
miner's candle	<i>Cryptantha nubigina</i>	Crnu	
shooting star	<i>Dodecatheon spp</i>	Dodecatheon spp	
mustard	<i>Draba spp</i>	Draba spp	
3 leaf daisy	<i>Erigeron compositus</i>	Erco	

yellow umbrella-plant	Eriogonum flavum	Erfl	
alpine forget me not	Erithrichium elongatum	Erel	
blanket flower	Gaillardia aristata	Gaar	
scarlet gaura	Gaura coccinea	Gaco	
gentian	Gentiana spp	Gentianna spp	
geranuim	Geranium spp	Geranium spp	mostly Geranium viscosissimum
prairie smoke	Geum triflorum	Getr	
wild licorice	Glycyrrhiza lepidota	Glle	
broom snake weed	Gutierrezia sarothrae	Gusa	
hedysarum	Hedysarum spp	Hedysarum spp	
littleleaf alumroot	Heuchera parvifolia	Hepa	
Colorado rubber plant	Hymenoxys richardsonii	Hyri	
Missouri iris	Iris missouriensis	Irmi	
wild blue flax	Linum perenne	Lipe	
stone seed	Lithospermum ruderale	Liru	
mountain lomatium	Lomatium cous	Loco	
broom-rape	Orobranche spp	Orobranche spp	
owl-clover	Orthocarpus spp	Orthocarpus spp	
stemless nailwort	Paronychia sesiliflora	Pase	
beard-tongue	Penstemon spp	Penstemon spp	
prairie clover	Petalostemon spp	Petalaostemon spp	Petalostemon candidum and purpureum
limber pine	Pinus flexilis	Pifl	
plantain	Plantago spp	Plantago spp	
stonecrop	Sedum spp	Sedum spp	
goldenrod	Solidago multiradiata	Somu	
blue-eyed grass	Sisyrinchium sarmentosum	Sisa	
snowberry	Symphoricarpos alba	Syal	
dandelion	Taraxicum spp	Taraxicum spp	
goatsbeard	Tragopogon dubius	Trdu	
townsendia	Townsendia spp	Townsendia spp	
clover	Trifolium spp	Trifolium spp	
American vetch	Vicia americana	Viam	
death camas	Zygadenus venenosus	Zyve	